

Harding Lawson Associates

FINAL DRAFT

**Phase I Work Plan
Drum Removal Action
Omega Chemical Facility
12504 East Whittier Boulevard
Whittier, California**

Engineering and Environmental Services



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Prepared for

Omega Chemical Site PRP Organized Group

c/o Boone and Associates
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HLA Project No. 32026 13

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June 12, 1995



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1.0 INTRODUCTION

This Phase I Work Plan (Plan) has been prepared for the Omega Chemical Site PRP Organized Group (PRP Group) by Harding Lawson Associates (HLA). This Plan has been prepared in response to the Administrative Order (Order No. 95-15) pursuant to Section 106 of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) of 1980, as amended, 42 USC Section 9606 (a), issued by the U.S. Environmental Protection Agency (EPA) and dated May 9, 1995.

1.1 Objective

HLA has prepared this Plan for the removal of drummed wastes and decontamination of equipment from the Omega Chemical facility (Site) located at 12504 East Whittier Boulevard in East Whittier, California. The work effort required to properly remove and dispose of the drums and decontaminate equipment will collectively be called the Drum Removal Action (DRA).

The Order states that the activities outlined in the Phase I Work Plan must be completed within 60 calendar days from approval of the Plan. This Plan presents HLA's approach to the tasks required to properly manage, transport, and dispose of the drums by determining the hazards associated with the drum contents.

The Plan consists of the following elements:

- Site Safety and Health Plan (SSHP)
- Work Plan (WP)
- Transportation and Disposal Plan (TDP)
- Sampling and Analysis Plan (SAP)
- Data Collection Quality Assurance Plan (DCQAP)
- Contingency Plan

1.2 Site Description

The Site is located at 12504 East Whittier Boulevard, Whittier, California (see Plate 1). The Site is approximately 40,000 square feet in area and consists of two buildings: a warehouse (150 by 160 feet) and an administrative building (80 by 30 feet) surrounded by a service yard. The west, east, and south boundaries of the Site are enclosed with a concrete block wall approximately 2 feet high. Additionally, a fence reaches a maximum height of 4 feet along the northeast boundary of the Site.

Adjacent to the Site and to the east is an indoor roller skating rink called Skateland, and west of the Site is Kaiser Hospital. Residential areas are located across the street and to the south of the Site.

The Order reports the numerous hazardous waste process units that were identified on Omega's RCRA Part A permit; however, all of these units were not observed at the Site during the March 14, 1995, Site visit by HLA.

The following units have been identified on Omega's RCRA Part A permit:

- 600-gallon storage tank (unknown contents)
- 20-gallon-per-hour incinerator
- 2,000-gallon-per-day pH modification chemical treatment unit
- 2,000-gallon-per-day organic compound reaction chemical treatment unit
- 0.5-ton-per-hour thermal treatment unit
- 20,000-gallon-per-day low temperature oxidation chemical treatment unit
- 2,000-gallon-per-day dewatering/drying physical treatment unit
- 2,000-gallon-per-day distillation physical treatment unit
- 3,000-gallon-per-day evaporation physical treatment unit
- 2,000-gallon-per-day solidification/stabilization physical treatment unit
- 200,000-gallon storage tank

The following provides a description of the process or waste management units that were identified on the Site during the Site visit and are included in the DRA (see Plate 2):

- Approximately 2,000 55-gallon drums are located throughout the outside service yard and approximately 1,000 drums are located inside the warehouse, as shown on Plate 2. These drums remain from previous Site operations and are reported to contain primarily halogenated

compounds and hazardous wastes with characteristics of ignitability and corrosivity. The drums outside, in the service yard, are stored on two large concrete pads.

- Five 5,000-gallon aboveground storage tanks (ASTs) are located in the western portion of the Site are reportedly contain process sludge. The tanks sit on a concrete pad and are surrounded by low walls.
- A rainwater sump is located in the southern portion of the Site and is considered to have served as a point of collection for surface runoff.
- Two distillation columns and two evaporators are located on the Site.

1.3 Site History

Omega Chemical Corporation (Omega) is a California corporation that had corporate offices in Whittier, California, from 1976 until at least 1991. The Site, located at 12504 East Whittier Boulevard, operated as a spent solvent recycling and treatment facility. The Site is currently owned by Mr. Dennis O'Omeara, president of Omega. Drums and bulk loads of waste solvents and chemicals from various industrial activities were processed to produce commercial products. Chemical, thermal, and physical treatment processes were used to recycle and reuse the wastes. Wastes generated from these treatment activities included still bottoms, aqueous fractions, and nonrecoverable solvents.

The following historical information regarding the drums has been summarized from the Order. The accuracy of the following information has not been independently verified.

The Site is known to have operated as an offsite hazardous waste treatment and storage facility under Interim Status designation from 1976 until 1991.

Omega entered into an Administrative Order on Consent, EPA Docket No. RCRA-09-91-0005 ("RCRA Order") to implement a RCRA facility investigation and interim measures, which were signed by EPA on October 17, 1991.

On August 27, 1993, at the request of the Department of Toxic Substances Control (DTSC), EPA Federal On-Scene Coordinator, Mr. Richard Martyn, tasked the Technical Assistance Team (TAT) to conduct a site assessment at the Site. Mr. Martyn is also the EPA On-Scene Coordinator for the Phase I work. The following observations were made during the assessment:

- Approximately 3,000 drums of hazardous waste were observed to entirely fill all available storage space onsite.
- Drums were sometimes stacked on pallets, and in rows three high.
- Many drums were weathered; however, only a few drums were noted as leaking.

The conclusion of the assessment was that Omega represented a significant waste management problem; however at that time the DTSC was working with Mr. O'Meara, and it was recommended to retain the DTSC as the lead agency.

In January 1995, a second preliminary assessment of the Site was performed by the EPA and the following observations were made:

- Over 3,000 drums were present stacked three high, some without pallets between them
- A large majority of the drums appeared to be extremely corroded
- Numerous drums were observed leaking into other drums and onto the concrete pad
- Numerous spills were observed leading away from the drums to other parts of the property

1.4 Status of Drums

On March 16, 1995, HLA personnel visited the Site to assess the status of the drums located at the Site. Approximately 2,000 55-gallon drums were counted in the outside service yard and approximately 1,000 55-gallon drums were located in the warehouse. Approximately 83 of these drums have been overpacked by IT Corporation because of deteriorated drum conditions. IT Corporation's Hazard Characterization (HazCat®) analyses on these drums revealed halogenated compounds and hazardous waste characteristic of ignitability and corrosivity.

Labels identifying the exact contents of the drums were not evident. None of the drums with secured tops were opened, so the exact contents of most of the drums remain unknown.

1.5 Project Schedule

Appendix A includes a schedule of the activities associated with this Plan.

2.0 ORGANIZATIONAL RESPONSIBILITIES AND CONTACTS

2.1 EPA On-Scene Coordinator

The EPA has designated Mr. Richard Martyn to serve as the EPA On-Scene Coordinator. Mr. Martyn will be present onsite or will be available during Site activities. The EPA On-Scene Coordinator will work with the Project Coordinator; together they are responsible for overseeing the implementation of the Order. All communications, documents, reports, and other correspondence between the PRP Group and the EPA regarding the activities onsite relevant to the Order will be directed through the EPA On-Scene Coordinator and the Project Coordinator.

2.2 Project Coordinator/Senior Superfund Project Manager

The Project Coordinator/Senior Superfund Project Manager will initially be Dr. Rajeev Sane; however, the position will be transferred to Dr. Ian Webster after the first few weeks of project implementation. The Project Coordinator/Senior Superfund Project Manager supervises all activities at the Site. The Project Coordinator will be onsite to sign manifests and to review DRA progress. The EPA On-Scene Coordinator will work with the Project Coordinator; together they are responsible for overseeing the implementation of the Order. All communications, documents, reports, and all other correspondence between the PRP Group and the EPA regarding the activities onsite relevant to the Order will be directed through the EPA On-Scene Coordinator and the Project Coordinator.

2.3 Program Manager

The Program Manager has overall responsibility for HLA in the execution of work at the Site. The Program Manager is Mr. Matthew McCullough, P.E. Mr. McCullough will work with the Project Manager to evaluate and resolve regulatory issues related to the DRA and will be available to support the Project Coordinator and EPA On-Scene Coordinator throughout the DRA. The Program Manager also serves as the advisor to the PRP Group on regulatory and technical strategies.

2.4 Project Manager

The Project Manager reports to the Program Manager and has responsibility for performance of technical aspects of work for the project. Mr. Andrew Keller will be the Project Manager for all phases of the project.

2.5 Site Supervisor

The Site Supervisor is Mr. Jim Hardesty. Mr. Hardesty is responsible for field implementation of the SSHP. As part of the requirements of the SSHP, the Site Supervisor will coordinate daily tailgate safety meetings; will work with the Field Activities Manager to establish the exclusion, contamination reduction, and support zones; and will ensure that the respiratory protection program is implemented and decontamination procedures meet established criteria. The Site Supervisor will also serve as the liaison between the EPA On-Scene Coordinator and Project Coordinator with the Project Manager.

2.6 Field Activities Manager

The Field Activities Manager is Mr. Ed McGlothin. Mr. McGlothin will direct the field activities onsite during the drum and waste removal and decontamination activities. He will supervise field efforts and communicate regularly with the Site Supervisor and Project Manager regarding the status of the project.

2.7 Project Chemist

The Project Chemist is Mr. John Gaudot. Mr. Gaudot will be the primary point of contact for the onsite HazCat® analytical laboratory and if any samples require offsite laboratory analysis, he will coordinate sampling/laboratory analysis activities. Mr. Gaudot will provide oversight and quality assurance and quality control (QA/QC) of HazCat® and offsite analytical activities.

2.8 Project Safety Officer

The Project Safety and Health Officer (PSHO) is Mr. Chris Corpuz. Mr. Corpuz has developed the SSHP and serves as the primary advisor for health and safety-related issues. The Site Supervisor is responsible for field implementation of the SSHP.

2.9 QA/QC Officer

The QA/QC Officer is Mr. Doug Alvy. Mr. Alvy will assist the Program Manager in the removal and decontamination phases of the project and will ensure that all QA/QC procedures are followed and met.

2.10 Field Technicians

Field Technicians will be involved in the drum removal, tank decontamination, equipment facility decontamination, hazard characterization, and waste disposal activities onsite.

2.11 Environmental Specialist

The Environmental Specialist will operate, maintain, and calibrate the weather station and ambient air monitoring equipment. He will also maintain daily logs and record daily observations of the weather conditions during the DRA.

2.12 Organization Chart

An organizational responsibilities chart is provided in Appendix B.

3.0 SITE SAFETY AND HEALTH PLAN

3.1 Introduction

It is HLA's intent to provide a safe work environment for employees and subcontractors. This SSHP has been developed to fulfill the following objectives:

1. Instruct employees and subcontractors on procedures to minimize the potential for injury or exposure to a hazardous condition.
2. Train employees and subcontractors on the proper action to be taken if a hazardous condition cannot be avoided by engineering controls.
3. Provide guidelines for emergency response for known hazards and hazardous situations.
4. Specify actions required to comply with applicable (1) Occupational Safety and Health Administration (OSHA) regulations and (2) state and local regulations or other requirements.

3.1.1 Purpose of the Site Safety and Health Plan

This SSHP is intended as a guideline that allows the SSHO to respond to changing conditions and make professional judgments regarding the interpretation of monitoring data and related control measures. This SSHP also delineates health and safety responsibilities and assigns those responsibilities to project and office personnel. This document is to be read and understood by Site personnel. The specific requirements of this SSHP apply to HLA employees and subcontractors involved in implementing the DRA work. It is not applicable to other contractors and/or Site tasks unless authorized for such use by a designated HLA representative. Site personnel (employees and subcontractors) must be permitted access to this SSHP upon request. Site personnel are required to sign this SSHP as an acknowledgement of agreement, acceptance, and understanding of the contents.

3.1.2 Scope of Work

HLA will sample, characterize, and remove approximately 3,000 drums of unknown chemicals from the Site for appropriate disposal. This will involve industrial and hand-held equipment (e.g., forklift, tools) onsite. Drums will be opened and sampled. Site personnel will use hand tools and an air monitoring device such as a photoionization detector (PID) or a flame ionization detector (FID). Deteriorated drums will be overpacked and moved offsite for appropriate disposal using a forklift, hand tools, and a heavy-

duty truck. Decontamination of ASTs, distillation columns, evaporators, a sump, drum storage pads, and other equipment will be performed.

3.1.3 Implementation and Modification of the Site Safety and Health Plan

Before any activities begin on or around the Site, a health and safety tailgate meeting will be held with Site personnel to discuss safety procedures and to familiarize personnel with the potential hazards of the Site. Changes in this SSHP will be discussed with the Designated Safety and Health Officer (DSHO) before being applied at the Site. Site personnel will be informed of changes during the weekly tailgate meetings or when Site conditions or risks change.

The SSHO will perform daily inspections of the Site dependent on field activities. If any operation, practice, or equipment does not pass inspection, the SSHO will document the item in the logbook and initiate corrective actions. The SSHO will notify the DSHO of inspection findings, as appropriate. Operations will cease or the faulty equipment will be removed, as appropriate. Unacceptable practices and/or faulty equipment will be remedied immediately, and the SSHP will be modified to correct any deficiencies.

3.1.4 Approval of the Site Safety and Health Plan

Plan Prepared By: Carol Hamilton
(Name)

(Signature)

Staff Environmental Scientist
(Title)

(Date)

Plan Approved By: Andrew Keller
(Name)

(Signature)

Associate Environmental Scientist
(Title)

(Date)

Chris Corpuz
(Name)

(Signature)

Associate Industrial Hygienist
(Title)

(Date)

Plan Revised By:

(Name)

(Title)

(Signature)

(Date)

(Name)

(Title)

(Signature)

(Date)

3.2 Site and Project Information

This section provides a general description of the Site and a discussion of chemicals previously detected in onsite media and chemicals suspected to be present onsite. A discussion of Site zones is also provided.

3.2.1 Site Location and Description

The Omega Chemical Site is bounded on the northwest by Pacific Place, on the southeast by Washington Boulevard on the northeast by Whittier Boulevard and on the southwest by Putnam Drive. The Site is approximately 40,000 square feet and is comprised of two buildings, a warehouse and an administrative building; both are surrounded by a service yard. The size of the warehouse is approximately 150 by 160 feet and the administrative building is approximately 80 by 30 feet. A site lan is presented as Plate 2.

The Omega Site includes approximately 3,000 55-gallon-drums containing a variety of unknown materials. A large number of drums appear to have deteriorated due to long-term storage and exposure to the weather; however, only a few of the drums inspected displayed any signs of gross deterioration or leakage.

3.2.1.1 Site Status

☐ Active/Open ☐ Inactive/Open ☒ Inactive/Closed ☐ Unknown

3.2.1.2 Site History

The Omega Site was a spent solvent recycling and treatment facility (primarily chlorinated hydrocarbons and chlorinated fluorocarbons) that operated from 1976 until at least 1991. Omega utilized a variety of chemical, thermal, and physical treatment processes to recycle and reduce wastes. Drums and bulk loads of waste solvents and chemicals from various industrial activities were processed to produce commercial products. Waste generated from the treatment activities included still bottoms, aqueous fractions, and non recoverable solvents. The Omega Site entered into an Administrative Order on Consent, to implement a RCRA facility investigation and interim measures, which was signed by EPA on October 17, 1991. On August 27, 1991, the DTSC requested the EPA to conduct a Site assessment at the Omega Site. The conclusion reached from the 1993 Site assessment was that Omega represented a significant waste management problem; however, the state was working with the owner/operator, and the Site should retain a state lead. In January 1995, the Superior Court ordered that all operations cease at the Site.

3.2.1.3 Surroundings

The Site is surrounded by Presbyterian Hospital, Nelles School for Boys, and Whittier Union High School. The area is well developed with primarily industrial, commercial, and residential areas. Additionally, the Puente Hills are located north of the Site.

3.2.1.4 Climate

Average Wind Speed and Direction: 7.5 (mi/hr) from the west-southwest

Humidity: x Arid ___ Semiarid ___ Humid ___ Tropical

Nov

Mean High Temperature (°F) 75.1

Mean Low Temperature (°F) 56.8

3.2.1.5 Locations of Resources Available to Onsite Personnel

Toilet facilities: Onsite

Drinking water supply: Onsite

Telephone: Onsite

Radio: N/A

3.2.2 Chemicals Detected in Onsite Media

Not applicable to the DRA.

3.2.3 Chemicals Suspected to be Present Onsite

Chemicals that have not been detected onsite but that HLA suspects may be present onsite include dilute aqueous waste, still bottom residuals, and non-recyclable organic wastes.

3.2.4 Site Zones

Site zones will be established to prevent or minimize exposure (of unauthorized personnel) to hazards by establishing boundaries to reduce migration of contaminants into clean areas. A three-zone approach will be used for field activities, as appropriate (e.g., nonhazardous work sites do not require the use of site zones). The zones will be determined by the SSHO and/or the Site Supervisor and will be identified during safety briefings, as well as clearly marked by traffic cones, fencing, barricades, signs, or other means. These three zones will be designated as the Support Zone, the Contamination Reduction Zone, and the Exclusion Zone. Site entrance and exit will be through controlled access points established for each work location.

3.2.4.1 Support Zone

The Support Zone is the clean area in which the possibility of encountering hazardous materials or conditions is minimal. Therefore, personal protective and respiratory equipment are not necessary. Inside the Support Zone, the following will be available: an effective means of communication, first-aid supplies, fire extinguisher, drinking water, and other appropriate support equipment. The Support Zone will also serve as the main point of contact for the visitor check-in and initiation of emergency services when necessary.

3.2.4.2 Contamination Reduction Zone

The Contamination Reduction Zone is the area where equipment and personnel are decontaminated before leaving the Exclusion Zone. Personnel will remove and/or decontaminate personal protective equipment (PPE) and place it in appropriate containers. Site vehicles and equipment will also be decontaminated in the Contamination Reduction Zone. The Contamination Reduction Zone will consist of a decontamination pad (temporary or permanent); a means of washing protective equipment, site vehicles, and equipment; containers for liquids, solids, and PPE; first-aid supplies; an eyewash/emergency shower; and a fire extinguisher.

3.2.4.3 Exclusion Zone

The Exclusion Zone includes the work activities at the Site (e.g., initial drum handling, sampling, and steam cleaning etc.). Only authorized, trained, and qualified personnel with the appropriate personal and respiratory equipment will be admitted. Personnel entering the Exclusion Zone must use the buddy system.

Work activities within the Exclusion Zone pose the greatest possibility of exposure to personnel and equipment. The Site Supervisor will be responsible for controlling the access points and keeping bystanders and unauthorized personnel to a minimum. The Exclusion Zone will be clearly marked with flagging, fencing, barricade tape, traffic cones, or other indicators to limit access.

3.2.5 Site Control

The Site will be enclosed by an 8-foot high chain-link fence with razor wire top to maintain Site control at the facility prior to initiation of field activities.

3.3 Project Organization and Personnel Requirements

This section presents discussions of health and safety responsibilities of key personnel and HLA personnel requirements.

3.3.1 Organization and Safety Responsibilities

To meet its health and safety objectives, HLA has developed a line of reporting and tasked individuals with health and safety responsibilities. This information is presented below. Exhibit 1 presents an organization flow chart illustrating the lines of reporting for the personnel noted in this section.

PROGRAM MANAGER: Matthew McCullough
(Name)

To receive, consider, and initiate action upon recommendations from project personnel and/or the DSHO. Overall responsibility for the implementation and effectiveness of the HLA Health and Safety Program.

PROJECT MANAGER: Andrew Keller
(Name)

Acquaint field personnel with potential hazards and procedures to minimize the negative impact of those hazards. Make available proper PPE, adequate time and budget, and trained personnel to perform site work in a safe manner. Arrange for preparation of an SSHP. Investigate and report to the DSHO each work-related illness or injury, near-misses, accidents, and damage to physical property.

DESIGNATED SAFETY AND HEALTH OFFICER: Mike Polkabila
(Name)

Write or review and approve the SSHP. Implement health and safety procedures that are stated in the SSHP. Conduct periodic audits to confirm that the SSHP is being followed. Select PPE and monitoring instruments to be used at the field site. Revise SSHPs based on advisories received from the SSHP based on actual site conditions.

SITE SUPERVISOR: Jim Hardesty
(Name)

Ensure that site personnel have read and signed the master copy of this document Exhibit 2. Coordinate with the SSHP on accident investigations, as necessary. (See Accident Investigation Form in Exhibit 3)

SITE SAFETY AND HEALTH OFFICER: Jim Hardesty
(Name)

Ensure that the guidelines, rules, and procedures in this document are followed for Site work. Check that Site personnel meet OSHA requirements regarding training, medical examinations, and fit testing. Be familiar with local emergency services. Conduct a tailgate health and safety meeting before work startup and weekly thereafter. Additional meetings may be required for specific projects or Site activities. Maintain and inspect PPE and monitoring instruments, monitor onsite hazards, and monitor the physical condition of Site personnel. Perform daily inspections of work site activities. Maintain health and safety files, which will include training and medical certifications, tailgate meeting notes and rosters, inspection reports, or other health and safety documentation, as applicable. Shut down operations that pose a potential threat to site personnel.

TECHNICIANS: Dave Hill, Alex Vargas, and Wes Haydock
(Names)

Obey health and safety work practices issued by law and by HLA. Wear PPE as directed by this SSHP. Use safety equipment as directed by this SSHP.

VISITORS

Follow the direction of the Site Supervisor or the SSHO. Read, understand, and sign the SSHP. Do not enter the work zones unless the appropriate OSHA-required training and medical monitoring has been obtained. Use PPE, as appropriate.

SUBCONTRACTORS: Allwaste, ENSCO
(Name)

Follow the guidelines, rules, and procedures in this document. Report recognized unsafe conditions and actions to the SSHO and/or the Site Supervisor. Provide Material Safety Data Sheets (MSDSs) for subcontractor-provided materials at the job site.

3.3.2 Personnel Requirements

A minimum of two personnel must perform the Site activities for this project; however, a total of twelve personnel is the maximum anticipated to be on the Site at a given time. The project is expected to take 60 days for completion.

3.4 Project Hazard Identification and Mitigation

This section discusses general health and safety work practices and hazard identification and mitigation. PPE and monitoring instruments that will be used onsite are also discussed.

3.4.1 General Health and Safety Work Practices

HLA's general safety policy advocates exercising every reasonable precaution when performing the work to prevent property damage and to protect the health and safety of employees, the public, and the environment.

Employees have certain responsibilities for their own safety, as follows:

- Report to work rested and physically and mentally fit to perform the job assignment.
- Working while under the influence of intoxicants, narcotics, or controlled substances is prohibited.
- Wear suitable clothing for the weather and the work.
- Wear PPE and follow established procedures for a particular job. Do not wear jewelry or loose-fitting clothing when operating or near equipment.
- Call the supervisor's attention to any behavior or condition that may cause injury or illness to others or damage to property.

- Read warning labels on containers and equipment. Follow specified precautions.
- Discontinue any operation that could lead to injury, illness, or property damage.
- Keep horseplay and other disruptive behavior away from the job.
- Promptly report to the Site Supervisor, SSHO, or DSHO any occupational injury, illness, or exposure to toxic material. If injured, get first aid. Small injuries can become serious if neglected.
- Promptly inform the Site Supervisor, SSHO, or DSHO whenever new substances, processes, procedures, or equipment that could present new safety and health hazards are brought into work areas or onto projects.
- Do not eat, smoke and/or chew tobacco, or chew gum in the Exclusion Zone or the Contamination Reduction Zone.
- Do not allow visitors without adequate safety training into the Exclusion Zone or the Contamination Reduction Zone.
- Work upwind of field activities when it is possible to do so.
- Perform work in a manner that will minimize dust from becoming airborne (i.e., use water spray or wet technique when feasible).
- Do not work alone inside the Exclusion Zone. Use the "buddy system" defined in OSHA 29 CFR Section 1910.120 or applicable state regulations during all work activities.
- Enter the Exclusion Zone only while in proper PPE and with a "buddy." The buddy system will also be in effect at any work zone where respirators are being worn.
- While in the Exclusion Zone, avoid contact with objects or soil unless the contact is necessary to the field operation.
- Be alert to abnormal behavior of other personnel that may indicate distress, disorientation, or other ill effects.
- Verify that vehicles have an ABC-rated fire extinguisher, a first-aid kit, and 32 ounces of eyewash fluid.
- Monitor weather conditions, particularly wind direction, because they could affect potential exposure.
- Be aware of the amount of solar radiation exposed skin is receiving. Take steps to minimize the potential for sunburn.
- Operate a vehicle only if you are a licensed driver. Seatbelts must be worn when operating a company vehicle or when driving a private vehicle on company business.
- Drive vehicles in a safe manner and obey traffic regulations.
- Operate a forklift only if you are a trained operator.
- Contact the DSHO if contact with human body fluids occurs during the administration of first aid.

These general safety responsibilities also apply to subcontractors and visitors.

3.4.2 Project Hazard Analysis

This section provides information regarding potential hazards that might be encountered during field activities and the risk(s) associated with each hazard. Projects are identified by activity numbers as follows:

Activity Number	Job Project
1	Mobilization/demobilization
2	Drum opening and sampling
3	Drum overpack and removal
4	Decontamination of AST's, distillation columns, evaporators, a sump, and drum storage pads

The hazard analysis evaluates the possible type of hazards at the site by project. This analysis is presented in Exhibit 4.

Procedures that will be used to minimize hazards identified onsite are listed in this section. The applicable activity number(s) is shown next to the procedure to mitigate the hazard. Hazards not presently applicable or anticipated to ever become applicable onsite are identified by "N/A."

Hazards	Activity Number	Procedures to Mitigate Hazards
Physical		
	<u>All</u>	Keep ground clutter in the work area to a minimum to minimize the potential for tripping.
	<u>All</u>	Use caution when the ground surface is slick or uneven.
	<u>All</u>	Clean up liquid spills or use sorbent material (e.g., dry soil) to minimize the potential for loss of footing.
	<u>4</u>	Use appropriate devices (e.g., ladder) to access high areas.
	<u>All</u>	Exercise caution when using hand tools.
	<u>All</u>	Use proper lifting and reaching techniques.
	<u>All</u>	Use hand carts or ask for assistance when lifting or moving heavy loads.
	<u>N/A</u>	Wear safety vests and be aware of motorized traffic when working in roadways or on road shoulders.
	<u>3</u>	Use a squeegee or a wide-head broom to guide drums into overpacks. Do not use hands, arms or legs to guide the drums.

Hazards	Activity Number	Procedures to Mitigate Hazards
Mechanical		
	<u>N/A</u>	Do not stand near backhoe buckets and earthmoving equipment.
	<u>2, 3</u>	Establish communication hand signals with heavy equipment operators.
	<u>All</u>	Verify daily that all equipment and associated tools are in good condition.
	<u>3, 4</u>	Do not stand or walk under elevated loads or ladders without appropriate guarding.
	<u>N/A</u>	Identify the drilling rig kill switches to personnel.
	<u>2, 3, 4</u>	Do not repair equipment while it is in operation.
	<u>All</u>	Immediately remove defective equipment from the work site for subsequent repair.
	<u>2, 3, 4</u>	Obtain safety training before operating heavy equipment, such as forklifts, bobcats, front-end loaders, and vacuum trucks.
	<u>All</u>	Wear a seatbelt if you are a heavy equipment operator or a motor vehicle occupant.
	<u>2, 3, 4</u>	Do not ride on the forks of lift truck, vacuum truck, or front-end loader buckets, or on a load, rigging, hook, or ball.
	<u>N/A</u>	Perform load tests (as required by OSHA regulations) on cranes and hoists before personnel are permitted to ride in the cage.
	<u>All</u>	Inspect motor vehicles and heavy equipment before operating.
	<u>2, 3, 4</u>	Do not wear loose clothing near operating equipment. Tie back long hair.
	<u>All</u>	Consult the DSHO if other mechanical hazards exist.
Electrical		
	<u>N/A</u>	Locate and mark buried utilities before drilling or excavating. Utilities located by _____ on _____. (To be completed by the Site Supervisor when location is complete.)
	<u>N/A</u>	Obtain permits, licenses, or right of entry required by local or state authorities.
	<u>N/A</u>	Maintain at least a 20-foot clearance (or minimum recommended by local utility company) from overhead powerlines. Contact the client for additional requirements.
	<u>N/A</u>	Contact the utility company for information regarding minimum clearance from high-voltage powerlines.
	<u>N/A</u>	If unavoidably close to buried or overhead powerlines, have power turned off, with circuit breaker locked and tagged or have the local utility company mask the wires.

Hazards	Activity Number	Procedures to Mitigate Hazards
	<u>All</u>	Properly ground electrical equipment. Use only three-wire grounded receptacles and extension cords.
	<u>All</u>	Do not stand in water when operating electrical equipment.
	<u>All</u>	Do not make electrical repairs or install electrical equipment unless you are qualified.
	<u>All</u>	If equipment must be connected by splicing wires, be sure connections are properly taped and that the splice is electrically and mechanically equal to the cord's quality.
	<u>All</u>	Be familiar with specific operating instructions for each piece of equipment.
	<u>All</u>	Consider all wires live until locked and tagged out.
	<u>All</u>	Do not use metal ladders within 4 feet of an electrical source.
	<u>All</u>	Use ground fault circuit interrupters (GFCIs) if operating outdoor electrical equipment.
Chemical		
	<u>All</u>	Use PPE as indicated in Section 3.4.3, or as directed by the SSHO.
	<u>2</u>	Conduct direct-reading air monitoring to evaluate respiratory and explosion hazards (list instrument, action level, monitoring location, and action to be taken in Section 3.5).
	<u>N/A</u>	Locate underground pipelines before drilling or excavating.
	<u>All</u>	Do not use spark-ignition equipment when in a flammable or combustible environment.
	<u>All</u>	Do not smoke, except in designated areas.
	<u>N/A</u>	Use fans to disperse airborne contaminants at the work site. No sparking or open flame equipment will be permitted inside the Exclusion Zone if there is a potential of reaching the Lower Explosive Limit (LEL) of contaminants present at the site.
	<u>All</u>	Respirators with high-efficiency particulate/air (HEPA) filters should be worn if there is a potential for contaminated dust at the site, or if asbestos-containing material (ACM) is being disturbed.
	<u>N/A</u>	Thoroughly ventilate chemical storage areas before entering.
	<u>All</u>	Consult the DSHO or SSHO for personal air monitoring.

Hazards	Activity Number	Procedures to Mitigate Hazards
Temperature		
Heat stress		
	<u>All</u>	When temperature exceeds 70°F, take frequent breaks in shaded area. Unzip or remove coveralls during breaks. Have cool water or electrolyte replenishment solution available. Drink small amounts frequently to avoid dehydration. Count the pulse rate for 30 seconds as early as possible in the rest period. If the pulse rate exceeds 110 beats per minute at the beginning of the rest period, shorten the work cycle by one-third.
Natural		
	<u>All</u>	Wear long sleeves and/or sun block on sunny days.
	<u>All</u>	Cease field activities during severe storms. Seek shelter until the storm has passed.
	<u>N/A</u>	If an earthquake occurs while working outside: <ul style="list-style-type: none"> - Stay away from buildings, trees, and power lines. - If operating a motor vehicle or heavy equipment, stop immediately but stay in the vehicle or piece of equipment until the tremors have stopped.
	<u>All</u>	Use a moisturizing cream before and after work as necessary to minimize wind burn.
Biological		
	<u>N/A</u>	Do not touch infectious waste or any items suspected of being infectious waste.
	<u>All</u>	Do not approach or agitate animals, especially ones behaving strangely or foaming at the mouth.
	<u>N/A</u>	Do not touch refuse suspected of being from a biological or animal laboratory. Contact the DSHO for procedures involving biological laboratory refuse.
	<u>N/A</u>	If possible, avoid contact with poisonous snakes or other reptiles by quietly walking away. If bitten, seek medical assistance immediately.
	<u>All</u>	Avoid contact with rodents because they frequently are hosts to fleas, which can carry typhus and the plague. Rodent urine and feces may also contain spirochetes harmful to human health.
	<u>All</u>	Avoid encounters with stinging insects.

Hazards	Activity Number	Procedures to Mitigate Hazards
Fire/Explosion		
	<u>All</u>	Use a fire extinguisher only to escape or to fight very small fires. Do not attempt to fight large fires.
	<u>All</u>	Field vehicles must have a 5-pound ABC-rated fire extinguisher.
	<u>3,4</u>	Heavy equipment (e.g., drilling rig) must have a 20-pound ABC-rated fire extinguisher.
	<u>All</u>	Obtain fire extinguisher use training.
	<u>All</u>	Obtain "hot work" permits when appropriate.
	<u>N/A</u>	Work with explosives or around unexploded ordnance at a site only if you are authorized and qualified to do so.
	<u>All</u>	Explosive or flammable material will be stored only in approved facilities as described in 27 CFR Section 181 or applicable state regulation.
	<u>All</u>	Do not smoke or operate spark-ignition equipment within 50 feet of explosive or flammable storage or where flammable liquid or vapor is present.
	<u>N/A</u>	Do not use equipment that may generate a spark where the potential presence of explosive gas or vapor is suspected. At these sites, an explosimeter must be used.
	<u>N/A</u>	Use a combustible gas indicator when working at a site with the potential for explosive gas or when the potential for flammable vapor exists.
	<u>N/A</u>	Use fans as an engineering control to limit buildup of explosive gas.

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- 1 = Mobilization/demobilization
 2 = Drum opening and sampling
 3 = Drum overpack and removal
 4 = Decontamination of AST's, distillation columns, evaporators, a sump, and drum storage pads

3.4.3 Required Personal Protective Equipment and Related Safety Equipment

This section describes the available levels of PPE as specified by 29 CFR 1910.120 Appendix B. The SSHO will be responsible for selecting the PPE appropriate to the actual work site conditions. Site personnel will only use PPE for which they have received training on the appropriate use and inspection. PPE for HLA employees will be supplied by HLA. Subcontractors and Site visitors will be required to supply their own PPE.

3.4.3.1 Levels of Personal Protective Equipment

Level D PPE

A work uniform affording minimal protection used for nuisance contamination only. The following constitute Level D PPE, which may be used as appropriate:

- Coveralls or field clothing
- Gloves (optional as applicable)
- Boots/shoes; chemical-resistant, steel toe and shank
- Safety glasses or chemical splash goggles
- Hardhat (optional as applicable)
- Earplugs and/or earmuffs (optional as applicable)
- Escape mask (optional as applicable)
- Face shield (optional as applicable)

Modified Level D PPE

This level of protection applies when concentration(s) and type(s) of airborne substance(s) are known to be below the PELs/threshold limit values (TLVs). Air-purifying respirators should be readily available.

The following Modified Level D PPE, which may be used as appropriate:

- Chemical-resistant clothing
- Coveralls or field clothing
- Gloves, outer, chemical-resistant
- Gloves, inner, chemical-resistant
- Boots, chemical-resistant, steel toe and shank
- Safety glasses or chemical splash goggles
- Hardhat (optional as applicable)

- Earplugs and/or earmuffs (optional as applicable)
- Escape mask (optional as applicable)
- Face shield (optional as applicable)

Note: Use of an air-purifying respirator with Modified Level D PPE will constitute Level C PPE.

Level C PPE

This level of protection applies when the concentration(s) and type(s) of airborne substance(s) are known and the criteria for using air-purifying respirators are met. The following constitute Level C PPE, which may be used as appropriate:

- Full-face or half-mask, air purifying respirators (NIOSH-approved) with appropriate cartridges. Employees working on this project will use organic vapor/acid mist/HEPA filter cartridges
- Chemical-resistant clothing (hooded unless approved by the DSHO or SSHO)
- Coveralls or field clothing
- Gloves, outer, chemical-resistant
- Gloves, inner, chemical-resistant
- Boots, chemical-resistant, steel toe and shank
- Boot covers, chemical-resistant (disposable)
- Hardhat (optional as applicable)
- Earplugs and/or earmuffs (optional as applicable)
- Escape mask (optional as applicable)
- Face shield (optional as applicable)

Level B PPE

This level of protection applies when the highest level of respiratory protection is necessary but a lesser level of skin protection is needed. The following constitute Level B PPE, which may be used as appropriate:

- Positive pressure, full-face self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA (NIOSH-approved)
- Hooded chemical-resistant clothing

- Coveralls or field clothing
- Gloves, outer, chemical-resistant
- Gloves, inner, chemical-resistant
- Boots, chemical-resistant, steel toe and shank
- Boot covers, chemical-resistant (disposable)
- Earplugs and/or earmuffs (optional as applicable)
- Hardhat (optional as applicable)
- Earplugs and/or earmuffs (optional as applicable)
- Face shield (optional as applicable)

3.4.3.2 Unknown Situations

For unknown, uncharacterized, and unanticipated situations, field activities must begin in Level B PPE. Downgrade to Level C or D PPE will not be permitted until analytical data for the Site have been reviewed. The DSHO and/or the SSHO must approve the downgrade.

3.4.4 Air Monitoring for Project Operations

This section describes instruments and procedures that can be used for air monitoring activities. It may not be necessary to perform all of these activities at the Site. Final decisions regarding air monitoring will be made by the DSHO or the SSHO.

A daily monitoring log will be kept by the SSHO for each piece of air monitoring equipment. The following information will be recorded:

- Name and model number of the equipment
- Calibration information
- Field work to be performed
- Air monitoring results and monitoring locations
- PPE worn
- Accidents or incidents
- Unusual occurrences and personnel complaints

- Weather information
- Postcalibration results, if performed

Air monitoring will be performed in the breathing zone and at the openings or sample points of the drums. Monitoring will be performed in a continuous manner or approximately every other minute as necessary. Air monitoring results will also be recorded in a field logbook.

3.4.4.1 Gases and Vapors

A PID with a 10.2 eV lamp or FID will be used to monitor breathing zone concentrations of volatile organic compounds (VOCs). Monitoring will be conducted continuously during sampling or intrusive activities. Calibration of monitoring equipment will be performed daily before startup of work (Exhibit 5). Calibration gas to be used will be specific to the instrument per manufacturer instructions. Action levels for known contaminants will be based on the PEL or TLVs of the contaminants, whichever level is the most conservative. Action levels for unidentified total atmospheric organic contaminants are based on the following:

Instrument Reading for One Minute	Action
Background	Level D
Above background	Level D - introduce engineering controls (e.g., fans) and don respirator
Above background to <5 ppm above background	Level C
5 ppm above background	Level C - leave area, upgrade to Level B
5 to <500 ppm above background	Level B
500 ppm above background	Level B - leave area, upgrade to Level A
500 to 1000 ppm above background	Level A

3.4.5.2 Explosion Hazard

A combustible gas indicator (CGI) will be used at sites as appropriate to monitor the possible presence of explosive gases (e.g., methane). Equipment calibration will be performed daily before startup of work per manufacturer instructions (Exhibit 5). The alarm will be set to 10 percent of the LEL. If feasible, calibration gas to be used will be specific to the combustible gases suspected to be present.

Continuous monitoring for the presence of combustible gases will be performed at the sampling point. If the monitoring instrument indicates greater than 10 percent of the LEL, personnel must leave the area. Explosion-proof fans should be used to lower the LEL. Personnel must not reenter the area until the LEL is less than 10 percent.

3.5 Decontamination and Disposal Procedures

Procedures to be followed for equipment and personnel decontamination and disposal of investigation-derived material are described below.

3.5.1 Personnel Decontamination

The sequence for personnel decontamination for Level C PPE or Level B PPE field activities is described below. Personnel decontamination for Level D PPE or Modified Level D PPE activities will include the applicable procedures described below. Decontamination will occur at either a temporary job site decontamination pad or at a central decontamination pad as follows:

1. If gross contamination is present, wash PPE in detergent or other appropriate solution and rinse in clean water.
2. Remove disposable overboots (if used). Remove outer gloves.
3. Wash chemical-resistant boots with detergent solution and rinse with clean water.
4. Remove SCBA belt and straps (if used) and remove coveralls. Starting at the neck, roll the coveralls off from the inside out and down past the boots. Take care to prevent the release and dispersion of dusts or prevent contact with decontamination water that may have accumulated on the coveralls. Avoid contaminating clothing inside the coveralls during removal.
5. Remove the respirator. Clean and disinfect the respirators and place into a plastic bag for storage.
6. Place disposable PPE in an appropriate container (plastic garbage bags in drums) for disposal.
7. Remove liner gloves.
8. Thoroughly wash hands and face.

Each investigation-derived waste (IDW) drum will be issued a unique number. The number will be recorded on the drum and in a log. Information as to the drum contents, the location the contents were collected, and the date filled will also be recorded on the drum and in the drum log.

3.5.2 Investigation-Derived Waste Disposal

This section describes procedures for disposing of IDW.

3.5.2.1 Personal Protective Equipment

Used PPE will be placed in plastic garbage bags, placed in drums, and stored onsite until appropriate disposal is determined.

3.6 Emergency Procedures

Pertinent emergency information and the contingency plan are provided in this section.

3.6.1 Emergency Telephone Numbers

Ambulance: 911

Police: 911

Fire Department: 911

Hospital: Presbyterian Inter-Comm Hospital: (310) 698-0811 (Switchboard); (310) 698-2511

Poison Control Center: (213) 222-3212 (Los Angeles)

CHEMTREC: 1-800-424-9300

Client Contact: Ian A. Webster

Office: (213) 977-6382

Project Manager: Andrew Keller

Office: (714) 556-7992

Pager: (714) 291-7137

DSHO: Mike Polkabla

Office: (415) 884-3137

Pager: (415) 907-7544

RSO: N/A

Office: _____

3.6.2 How to Report an Emergency

When calling for assistance in an emergency situation, the following minimum information should be provided:

1. Name of person calling
2. Telephone number of caller's location
3. Name of person(s) exposed or injured

4. Nature of emergency
5. Actions already taken

The recipient of the call should hang up first - not the caller.

3.6.3 Emergency Routes

Name of Facility: Presbyterian Inter-Comm Hospital Address: 12401 E. Washington Boulevard

Telephone Numbers: (310) 698-0811 (Switchboard); (310) 698-2511 (Emergency)

Specific Directions: Exit to the north from the site then turn right onto Whittier Boulevard. Turn right on Washington Boulevard and the Presbyterian Inter-Comm Hospital will be on the right side of the road.

3.6.4 Emergency Signals

In the unlikely event that an emergency situation occurs, all field activities at that site will cease. The emergency situation will be signaled by a blast from a carbon dioxide (CO₂)-propelled air horn.

The following hand/body emergency communication signals should be used when other forms of communication are difficult or impossible:

Signal	Meaning
Hand clutching throat	Out of air/can't breathe
Hands on top of head	Need assistance
Thumbs up	OK/I'm all right/I understand
Grip partner's wrist or both hands around partner's waist	Leave area immediately

If the emergency occurs in the Exclusion Zone, all field personnel will quickly move to the Contamination Reduction Zone for an appropriate decontamination before exiting to the Support Zone. In life-threatening emergencies, decontamination may not be appropriate. The emergency decontamination decision will be made by the SSHO. Emergency situations occurring outside of the Exclusion Zone in Level D PPE will not require decontamination at the Contamination Reduction Zone before administering first aid.

Minor emergencies will be handled within the Support Zone utilizing the onsite first-aid kit. A portable emergency eyewash or a total of 32 ounces of eyewash fluid will be available in the field vehicle. Either

an emergency shower or a shower facility will be available for personnel decontamination. If working at a remote location (more than 15 minutes from an emergency medical facility), at least one onsite HLA person will be trained in first aid. Exhibit 6 is a summary of American National Red Cross first-aid procedures. The appropriate emergency response personnel (i.e., ambulance and fire department) will be contacted for all major emergencies.

Routes to the nearest hospital are provided at the front and the back of this document. Plate 3 also presents the route to the nearest hospital. The SSHO should drive the hospital route before field activities begin. A written report of all emergencies will be submitted to the DSHO. Accident forms are located in Exhibit 3. Copies of this report will also be sent to the appropriate agencies.

4.0 WORK PLAN

All activities will be conducted consistent with Occupational Safety and Health Administration (OSHA) regulations, Department of Transportation (DOT) requirements, treatment/disposal site or recycling facility acceptance parameters, and any other applicable federal, state, and local regulations.

4.1 Security and Access Restriction

The west, east, and south boundaries of the Site are currently enclosed with a concrete block wall approximately 2 feet high with a 4-foot-high fence on the northeastern boundary. As the current security for the Site has been determined in the Order to be insufficient in its ability to restrict access from persons who congregate at public facilities in the area of the Site, HLA will erect an 8-foot-high chain-link fence, with razor wire top, along the perimeter of the property, which is of sufficient height and design to control unauthorized access to the Site. Appropriate warning signs will be posted on the fence to help prevent exposure of unauthorized and unprotected people to Site hazards.

Site access will be controlled as follows:

- During drum removal activities the fence, signage, and onsite authorized personnel will provide security and access restriction.
- During off-hours and weekends the fence, signage, and a security guard will provide Site control.

4.2 Mobilization

Mobilization of Equipment and Personnel. Before initiation of the DRA, HLA will mobilize personnel and equipment to the Site and set up a temporary field office. It is anticipated that the current Omega facilities will be used as field offices and staging areas. If this is not a viable option, a portable trailer will be situated onsite to serve as a temporary field office.

SSHP Review. HLA has prepared an SSHP that covers all phases of this Plan and is included in Section 3.0. Onsite personnel performing the DRA will review the SSHP and sign the master copy of the document, indicating they have read and understand all elements of the SSHP. Copies of the SSHP will be available for their review and will be readily available onsite.

4.3 Establishment of Control Zones

Preparation of Control Zones. Control zones will be constructed and safety zones established by the Project Manager. Exclusion, contamination reduction, and support zones with access points will be established. The exclusion zones will be marked off with portable barricades and caution tape during drum removal and equipment decontamination to prohibit unauthorized personnel from entering the work area. It is currently anticipated that two sets of control zones will be utilized to efficiently implement the DRA.

Exclusion Zone. An exclusion zone is the area where contamination does or could occur. This zone has the highest potential for exposure to contaminants by dermal contact or inhalation. All personnel within the exclusion zone will wear Level B personal protective equipment (PPE), based on the EPA Level of Protection guidelines. The level of protection in this area may be modified to reflect any hazards discovered during the DRA. The exclusion zone will move, and continuously decrease in diameter, as drum removal activities progress. The exclusion zone will be divided into two areas: the drum storage area and the initial staging area.

The drum storage area comprises the area where drums are removed from their storage position. The drums will be visually inspected for structural integrity and possible hazards associated with drum handling. The drums will not be opened at this point but may be overpacked if warranted. The initial staging area will be established proximal to the drum storage area. The initial staging area comprises the area where drum opening, initial screening, and sampling occurs. Drums will remain in the initial staging area until HazCat® results are available. Additionally, an assessment of drum integrity and the drum's ability to be transported per DOT requirements will be made. Overpacking will be performed as necessary based on field observations. A forklift will be dedicated to work exclusively in the exclusion zone to minimize the hazard exposure and decontamination efforts.

Contamination Reduction Zone (CRZ). The CRZ is the transition between the exclusion zone and the support zone. The purpose of the zone is to reduce the probability that the support zone will become contaminated or affected by other Site hazards. The CRZ will be established just outside the exclusion zone. The CRZ will be the area where the sealed, characterized, and DOT-transportable drums are transferred to the transportation vehicles located in the support zone. A forklift will be dedicated to work exclusively in the CRZ to minimize hazard exposure and decontamination efforts. Additionally, the CRZ will be utilized for decontamination of technician's PPE and field equipment leaving the exclusion zone. The decontamination procedures are outlined in the SSHP, Section 3.0 of this Plan.

Support Zone. The support zone is the uncontaminated area where workers should not be exposed to hazardous conditions. This is the area used for administrative and other support functions needed to keep the operations in the exclusion zone and CRZ running smoothly. Supplies will be sent to the Site on an as-needed basis; therefore, a supply storage area is not necessary. Because of the limited working space at the Site, this zone will initially be quite restricted, but as drum removal activities progress it will increase in size. The Omega office or a portable trailer will be utilized for administrative purposes.

Posting. Portable barricades and caution tape will be employed in readily visible locations to delineate the exclusion zone, CRZ, and support zone, if determined necessary.

4.4 Establishment of HazCat® Stations

A HazCat® station will be established within the warehouse building at the Site (see Plate 2). The HazCat® System of Haztech Infosystems, Inc., is the field screening test system to be utilized in identifying the primary hazard characteristics of the drum contents. This system will identify compatible wastes and will be the basis for determining appropriate handling procedures, transportation, and disposal of the drums.

The station will be equipped with a chemical hood, under which characterization will be performed, and any necessary reagents, test papers, supplies, and protective clothing to facilitate testing.

Level C PPE will be used at the HazCat® station unless information gathered during the sampling indicates that additional PPE is necessary.

4.5 Waste Verification

Drum Inventory. HLA will mark each drum with a unique drum number and approximate location. This information and other markings on the drum exterior will be included in a drum inventory database along with other information that assists the drum removal activities. The drum inventory will consist of numbering the drums, visually inspecting drum conditions, and logging drum characteristics. The drums will be clearly numbered using paint sticks and paint pens.

Waste Identification/Verification. Each drum will be opened and the contents will be visually assessed (identified). Because current drum labeling is inadequate to verify specific drum contents and individual analytical reports are not available, the contents of drums containing wastes will be determined by sampling and HazCat® analysis. If the HazCat® of the drum contents is inconclusive, inconsistent, or of

concern to the field chemist, samples will be collected as described in Section 6.0 and taken to a state-certified laboratory for hazardous waste characterization. Refer to Section 6.0, Sampling and Analysis Plan (SAP), for a detailed description of activities. Those drums with discernible labels will be visually examined to assess whether any information recorded on the labels may be used to aid in waste profiling. Drums will also be inspected for leaks and other damages.

All applicable information will be entered in the drum inventory database.

4.6 Waste Sampling (HazCat® System)

Drum Handling Procedures. As part of the waste sampling procedures, drums will be moved from the storage location, utilizing a forklift by the pallet or with a drum grabber or picker, to the sampling location. Initially, the sampling area will be co-located near the drum storage area because of the confined conditions at the Site. As space becomes available the drum sampling area may be enlarged to accommodate more drums. Adequate volumes of absorbent will be kept nearby during drum moving. All personnel will be instructed on the hazards of drum handling before moving the drums and will be warned to be alert for new information about potential hazards.

Drums will be opened by personnel in Level B PPE. Before opening, all drum ring tops and/or bungs will be wiped clean and made free of debris. If a drum cannot be opened by conventional means, nonsparking puncturing tools may be used. Bulging drums, if encountered, will be vented through the vent bungs before being opened. Field personnel will not attempt to puncture a bulging drum that cannot be vented by conventional means. Damaged drums that cannot be handled safely and open drums will be placed in overpack containers prior to movement, if necessary.

Refer to Appendix C for a more thorough description of appropriate drum handling procedures.

Drum Sampling. A detailed SAP is provided in Section 6.0, and the Data Collection Quality Assurance Plan (DCQAP) is provided in Section 7.0 of the Plan.

Sample Analysis. Representative samples of the waste from the drums will be taken to the HazCat® station for hazard characterization. The HazCat® System of Haztech Infosystems, Inc., is the field screening test system to be utilized in identifying the primary hazard characteristics of the drum contents. This system will identify compatible wastes and will be the basis for determining appropriate handling and transportation procedures and disposal options for the drums. A detailed description of the sampling procedures are provided in Section 6.0 SAP.

The appropriately trained HazCat® chemist will perform a HazCat® procedure based on industry standard practices. The tests will include a sulfide screen, cyanide screen, oxidizer screen, chlorinated screen (hot wire), pH test, water reactivity, and Char test. Based on the test results, further tests may be conducted to more fully characterize the wastes. All results from the HazCat® testing will be recorded on a HazCat® report form with the corresponding drum identification number.

4.7 Ambient Air Monitoring

The purpose of air monitoring is to identify and quantify airborne contaminants in order to verify and determine any potential offsite consequence from the DRA. A weather station will be centrally located on top of the warehouse to record the temperature and wind speed and direction. The weather station will be installed approximately 3 days prior to initiation of field activities so that Site-specific meteorological data can be gathered. The meteorological data will assist in determining appropriate sampling locations, average wind speeds for the area, and any unique macroclimatological effects caused by the Puente Hills, local topographical changes, and nearby building influences.

It is anticipated that two sampling locations, one upwind and one downwind, will be established at the Site. The upwind location will provide ambient air concentrations of selected chemicals prior to any potential contribution from onsite activities. The downwind sample location will provide both ambient concentration, in addition to any Site-specific contributions. The difference between the two locations can be attributed to Site activities.

Sampling performed at the upwind and downwind locations will include:

- Total Organic Vapors - Flame ionization detectors (FIDs) will be utilized to determine the total organic vapor concentration at the sampling locations. The sampling equipment will provide data in the parts per million range and serve to document any significant potential releases. Because of the industrial nature of neighboring properties, the potential exists that the upwind sampling location will have detectable concentrations of organic vapors. If the downwind concentration exceeds the average upwind concentration by more than 2 standard deviations of the upwind average, site activities will be stopped, and the source will be investigation. This equipment will be utilized on all days involving drum openings and equipment decontamination. If the daily monitoring indicates that no significant increase in the ambient air organic vapor concentration is attributable to the Site activities, the monitoring will be discontinued.

- Particulate Matter - A Miniram Model MIE PDM-3 will be employed to determine real-time aerosol and dust concentrations ranging from 0.01 to 100 mg/m³. The equipment will provide total particulate concentration at the upwind and downwind sampling locations. If the downwind concentration exceeds the upwind concentration by more than a factor of 10, Site activities will be stopped and the source of the particulate matter will be investigated. Appropriate dust/aerosol suppression methods will be implemented to control the source. No speciation of the particulate matter is anticipated at this time because of the limited potential for dust generation during the DRA. If the daily monitoring indicates that no significant increase in the ambient particulate matter air concentration is attributable to the Site activities, the monitoring will be discontinued.
- Speciated Volatile Organic Hydrocarbons - After approximately the first week of the DRA and routine operation is completed, upwind and downwind samples will be collected for speciated organic vapors. Two evacuated Summa canisters will slowly be released over a 4-hour period during routine operations. The canisters draw in the ambient air as the pressure starts to equilibrate with the atmospheric pressure. The canisters will be closed with approximately 5 inches of vacuum left to serve as a leak check during transfer for laboratory sampling. EPA protocols will be followed regarding the preparation, sampling, transfer, and analysis of the Summa canisters. EPA Methods 601/602 will be utilized to provide low (0 to 5 ppbv) detection limits for common industrial aromatic and chlorinated hydrocarbons. Two samples will be collected on three separate days to determine if any increased ambient air concentrations can be attributed to the DRA. Because of the industrial nature of neighboring properties, the potential exists that the upwind sampling location will have detectable concentrations of aromatic and chlorinated hydrocarbons.

All air monitoring equipment will be calibrated at the opening and close of each field day according to the manufacturer's recommended procedures. Equipment manuals will be kept with each instrument. Calibrations will be recorded on the appropriate calibration form. Equipment maintenance will be conducted, if required, following the manufacturer's recommended procedures. Any maintenance performed on the FID will be recorded on the instrument's calibration log.

4.8 Waste Sample Evaluation

Waste Sample Validation. After HazCat® results for the various waste streams are received by HLA, the results will be reviewed and validated following the DCQAP. The DCQAP is outlined in Section 7.0 of this Plan. The information will be included in the drum inventory database.

Waste Stream Characterization. HLA will use the results to characterize the various waste streams in relation to the applicable federal and state regulations to decide the recommended means of disposal or recycling.

4.9 Drum Labeling

Labeling of Drums. All drums will be marked, labeled, and/or placarded in accordance with all applicable federal and state laws and regulations. In addition to the marking and labeling required by law, the drums will also be marked with the drum identification number, as described in Section 4.5 of this Plan.

4.10 Waste Transportation and Disposal

Drums will be loaded onto the transportation vehicle once the waste has been characterized and as space becomes available on the transportation vehicle. The removal of drums will be an ongoing process, as the wastes will be sampled, analyzed, and characterized on a continuous basis. This method will allow for successively more space free of obstructions; therefore, the increased mobility will minimize potential hazards associated with working in confined areas.

The location of the drum loading stations will not be fixed. It will be necessary to adjust the locations as drum removal activities progress in order to ensure timely and efficient drum removal.

Initially, the two drum loading stations will be established at the north-northeast side of the Site and at the northeast side of the Site. The majority of drums are located in the service yard; however, there are drums inside the warehouse that require removal. The drums inside the warehouse will be moved via forklift to an initial staging area where drum opening, screening, and sampling will occur.

Drum Overpacks. If determined to be necessary from the visual assessment, drums may be overpacked and staged to meet transportation and disposal regulations.

Bulk Containerization. Two 30-yard roll-off bins are located at the south corner of the property. The roll-offs contain 55-gallon drum-shaped polyurethane hardened resins. If it appears the polyurethane was reacted in 55-gallon drums and the drums were then cut away. The hardened resins will be transferred into cubic yard, DOT-approved, boxes for shipment and disposal. If found to be safe and efficient, other wastes may be bulk containerized onsite.

Hazardous Waste Manifests. A uniform hazardous waste manifest will be completed for each shipment of hazardous waste. The manifest will be completed in compliance with all applicable federal and state laws and regulations. If a hazardous waste is to be transported out of state, the hazardous waste manifest appropriate for that state will be utilized. In addition, a land disposal restriction form will be attached to the manifest, if appropriate. All necessary signatures and information will be entered on the manifest prior to transportation of the hazardous waste.

Waste Disposal Options. Waste disposal options include the direct transportation of wastes to ENSCO's incineration facility. ENSCO's incineration facility is a Part B permitted RCRA facility, located in El Dorado, Arkansas, and is capable of storing approximately 31,000 drums. The facility can accept 55-gallon steel drums as well as all DOT-approved containers. Certificates of Destruction will be provided for all waste shipments that are incinerated.

Alternative TSDFs may be used if they are determined to be more appropriate than the proposed disposal facility. The most appropriate disposal facility will be determined based on the type of waste, hazardous classification, cost of disposal, and regulatory status of the waste facility. The determination of the appropriate disposal facility will be made onsite as the wastes are being characterized. Alternatively, if the waste is transported to a transfer facility, determination of the most appropriate disposal facility will be made once the waste has reached the transfer facility and disposal options have been explored. All TSDFs will be approved to accept CERCLA wastes.

4.11 Equipment Decontamination

Equipment to be decontaminated onsite currently includes five ASTs, five distillation columns, two evaporators, one rainwater sump, and two drum storage pads. After a detailed initial assessment, an updated equipment list will be prepared. The ASTs are assumed to contain wastes; all other structures are assumed to be empty.

Aboveground Storage Tanks. The contents of the five ASTs will be removed and the ASTs pressure washed or steam cleaned. The decontaminated surfaces then will be triple rinsed in accordance with industry standard protocols. If entry into the ASTs is required in order to decontaminate the structure, entry will be performed under confined space conditions. ASTs are anticipated to be able to be cleaned in one operation; however, this may change once a more detailed assessment of the condition and extent of contamination of the structures are performed.

Distillation columns. The five distillation columns will be either pressure washed or steamed cleaned, and all decontamination surfaces will be triple rinsed in accordance with industry standard protocols. Distillation columns are anticipated to be able to be cleaned in one operation; however, this may change once a more detailed assessment of the condition and extent of contamination of the structures are performed.

Evaporators. The two evaporators will be either pressure washed or steamed cleaned, and all decontamination surfaces will be triple rinsed in accordance with industry standard protocols. If entry into the ASTs is required in order to decontaminate the structure, entry will be performed under confined space conditions. Evaporators are anticipated to be able to be cleaned in one operation; however, this may change once a more detailed assessment of the condition and extent of contamination of the structures are performed.

Rainwater sump. The contents of the rainwater sump will be removed, the sump will be washed out with a pressure washer, then the decontaminated surfaces will be triple rinsed in accordance with industry standard protocols. The sump is anticipated to be able to be cleaned in one operation; however, this may change once a more detailed assessment of the condition and extent of contamination of the structure is performed.

Drum Storage Pad. The two drum storage pads will be steam cleaned, then the decontaminated surfaces will be triple rinsed in accordance with industry standard protocols. The storage pads are anticipated to be able to be cleaned in one operation; however, this may change once a more detailed assessment of the condition and extent of contamination of the structures are performed.

Obvious signs of visual contamination will be removed from equipment structures to eliminate any potential threat to human health or the environment. Because of the uncertainties associated with the ownership of the equipment, the final disposition cannot be determined at this time.

4.12 Decontamination Waste Disposal

Rinse water from equipment decontamination operations will be collected into temporary tanks, drums, or containers. The rinse waters will be managed and disposed of as hazardous wastes. The classification of the wastes will depend on the equipment from which the waste was derived and any additional knowledge obtained during decontamination activities that will aid in assessing the hazardous materials/wastes that the rinse water may be contaminated with. All rinse waters will be disposed of at an appropriate, permitted TSDF or recycling facility.

4.13 Weekly Progress Reports

Weekly written summary reports will be provided to the EPA which will include a summary of the current and future week's activities. The summary will contain information regarding changes in personnel, the percentage of the project that has been completed, potential problem areas, and the projected work for the following week. Refer to Exhibit A, in this section, for a sample report.

4.14 Technical Memorandum

To assist in documenting and detailing a course of action for unforeseen changes that may occur in the field, a technical memorandum will be written. The technical memorandum will be prepared to ensure a clear line of communication and submitted to the EPA for approval. The memorandum will include a brief description of the proposed addition or modification, the purpose of the proposed activity, its estimated cost and possible alternatives. Refer to Exhibit B, in this section, for a sample report.

4.15 Phase I Report

A final Phase I report detailing all Site activities will be prepared and provided to the EPA.

EXHIBIT A
WEEKLY PROGRESS REPORT FORM

EXHIBIT A
WEEKLY PROGRESS REPORT NO. ____
OMEGA CHEMICAL CORPORATION

- A. PERCENTAGE OF PROJECT COMPLETED
- B. SUMMARY OF WORK PERFORMED
- C. CHANGES IN REMEDIAL DESIGN/REMEDIAL ACTION
- D. SUMMARY OF COMMUNITY INTEREST GROUPS AND AGENCY CONTACTS
- E. POTENTIAL PROBLEM AREAS
- F. ACTIONS TO BE TAKEN
- G. CHANGES IN PERSONNEL
- H. PROJECTED WORK FOR NEXT REPORTING PERIOD
- I. INSPECTION REPORTS

EXHIBIT B
TECHNICAL MEMORANDUM FORM

EXHIBIT B
NO. _____ TECHNICAL MEMORANDUM

SUBJECT:
SUBMITTED BY:
SUBMITTED TO:
CC:

DATE:
TASK NO.:

-
- 1.0 PURPOSE
 - 2.0 DESCRIPTION OF REQUIRED ADDITION OR MODIFICATION
 - 3.0 NEED FOR PROPOSED ACTIVITIES
 - 4.0 IMPLEMENTATION SCHEDULE
 - 5.0 ESTIMATED COSTS
 - 6.0 EVALUATION OF ALTERNATIVE ACTIONS
 - 7.0 ALTERNATIVES FOR IMPLEMENTATION
 - 8.0 HEALTH AND SAFETY ISSUES
 - 9.0 DESIGN/IMPLEMENTATION PRECAUTIONS
 - 10.0 FUTURE IMPLICATIONS/CONSISTENCY WITH FINAL REMEDY

EPA APPROVAL BY: _____ **DATE:** _____

____ Approved ____ Disapproved ____ Additional Information Required
____ Approved Conditional Upon Attached Comments

5.0 TRANSPORTATION AND DISPOSAL PLAN

5.1 Overview

This Transportation Disposal Plan has been developed to provide the following:

- Proper completion of the Hazardous Waste Manifests,
- Proper completion of drum labels and other required documents,
- Proper loading of the truck according to DOT-requirements,
- Vehicle inspections prior to departure,
- Two main transportation routes from the site to the nearest freeway,
- Procedures to be strictly followed in case of an incident while in transport, and
- Discussion of proposed transfer and disposal facilities.

5.2 Checklist for Manifests

The following checklist will be utilized to ensure hazardous waste manifest are properly completed:

1. Only current manifests will be used. *Failure to have a current manifest will result in the material being returned to the generator.* For shipments manifested to Arkansas, an Arkansas manifest will be used and for shipments manifested to California, a California manifest will be used.
2. The Generator Certification section will be signed and dated.
3. The Transported Acknowledgment section will be signed and dated.
4. EPA ID numbers for generator, transporter and facility will be filled in.
5. Section 11a-11d will have a proper DOT shipping description for all regulated waste. DOT shipping descriptions will include the proper shipping name, hazard class, ID#, and packing group at a minimum.
6. EPA waste codes will be indicated in Section I, the Waste Number section. "NR" will be used for EPA non-regulated material and "PCB" will be used for Polychlorinated Biphenyls. (Shipments to Arkansas will use "NR" for EPA non-regulated material.)
7. Verification will be made to ensure that no waste codes are manifested that are unacceptable at the receiving facility.

8. Waste Profile (WP) number will appear on the manifest either in Section 11a-11d or Section 15. The WP numbers for the materials will agree with the WP numbers provided on the ENSCO Shipment Confirmation. The Site Supervisor will be notified of any discrepancy. Failure to have an approved WP number will result in the materials being returned to the generator.
9. The Load number will be indicated in Section 15.
10. 24-hour emergency response information (contact and phone numbers) will be listed in Section K.
11. Container types and numbers will be accurately indicated in Section 12 and correspond to the actual load count.

5.3 Land Disposal Restriction Notification Form

The following procedures will be implemented for completion of the land disposal restriction notification form for restricted wastes:

1. For any restricted waste, a Land Disposal Restriction Notification Form will be provided by the generator and attached to the manifest.

A Land Disposal Restriction Notification Form is not required for EPA non-hazardous material or PCB (non-RCRA) material, but they are required for mixed wastes (PCB & RCRA mixed).

2. Land Disposal Restriction Notification Form will be signed and dated by the generator.

5.4 Preparation/Shipment of Drums

The following procedures will be implemented during the preparation and shipment of drums:

1. Drums of EPA and California regulated waste will have hazardous waste level that includes:
 - Generator information,
 - DOT shipping name,
 - UN or NA number,
 - Manifest number and line,
 - EPA and California waste code numbers, and
 - The WP number for regulated and non-regulated materials.

EPA non-regulated material will have a non-hazardous label.

DOT regulated material will have the appropriate hazard class label(s).

3. PCB articles and material will have on each article or drum:

- PCB label
- the date the PCB's were removed from service (storage date)
- a unique identifying number

PCB shipping papers must include a list stating for each article or drum:

- the unique identification number
- waste type
- storage date
- weight in kilograms

4. Inspections of all loads will be made to ensure that all drums are properly secured and not leaking.

5.5 Loading Requirements

The following procedures and precautions will be implemented during the loading of the drums.

1. Guard the drum from hazards. The following precautions will be taken with all hazardous materials shipments:
 - Do not drop, jar, or bump the drum. Impact can cause breakage and release of hazardous materials, fumes or vapors.
 - Keep away from heat. Excessive heat, such as when drums are stored next to heating units or loaded into a trailer and left in the hot sun, can increase the possibility of hazard from hazardous materials.
 - Protect the drum from moisture. Moisture can deteriorate the structural integrity of the drums.
 - Keep drum loading and shipment area well ventilated. Air circulating between drums prevents fumes and materials from becoming mixed and contaminated each other.
 - Avoid friction against drum. Don't slide drums of hazardous materials, as heat generated through friction may create a hazard.
 - Check the characteristics of the loading guide (hazardous materials) to ensure that shipments of incompatible hazardous material not loaded together.
2. Check shipping papers to be certain they accurately completed. Drums must be in good condition and require appropriate labels and markings. Report any discrepancies to the Site Supervisor.
3. Smoking and open flames are prohibited around any unit being loaded or unloaded.
4. The parking brake on the vehicle must be set and the engine must not be running while the vehicle is being loaded or unloaded.

5. Tools which might damage the shipment must not be used on any drums.
6. When Class 4 Flammable solids, Class 5 Oxidizing materials, or Class 8 Corrosive liquids are transported, they are to be so loaded as to provide ready accessibility for removal.
7. All hazardous materials should be kept free from extreme changes in temperature.
8. Tanks, barrels, drums, and cylinders must be reasonably secured against movement within the motor vehicle during transport and against relative movement between each other. Such motion might create friction or cause damage to valves or fittings and result in dangerous leakage.
9. Heaters may be used when transporting Class 3 Flammable liquids or Class 2 Flammable gases, provided:
 - It is a catalytic heater;
 - The heater's surface temperature cannot exceed 130° F. (54° C);
 - The heater is not ignited in a loaded vehicle;
 - There is no flame, either on the catalyst or anywhere in the heater;
 - The heater bears the manufacturers' certification "Meets DOT requirements for catalytic heaters used with flammable liquid and gas."; and,
 - The heater is also marked "Do Not Load Into or use in cargo compartments containing flammable liquids or gas if flame is visible on catalyst or in heater."
10. Vehicles equipped with heaters, not meeting the specifications outlined above, may be used to transport Class 3 Flammable liquid or Class 2 Flammable gas **only** if the device is first rendered inoperable by emptying or removing the heater fuel tank, closing its discharge valve, and disconnecting its fuel feed line.
11. Damaged or leaking packages of hazardous materials may be reloaded into a recovery drum for shipment to destination. A recovery drum must be of metal construction. Cushioning must be provided if necessary, and there must be a means of absorbing any free liquid. The drum, the cushioning and the absorptive material must be compatible with the hazardous material. The drum must be marked with the proper shipping name of the hazardous material, the name and address of the consignee, labeled as required, and bear the additional marking "Recovery Drum". The capacity of a recovery drum must not exceed 110 gallons.
12. Transfer of Class 3 Flammable Liquids:
 - Transfer of Class 3 Flammable liquids between containers not in metallic contact may be made only if metallic bonds or ground conductor are provided. Such bonding shall be made by first connecting an electrical conductor to the container to be filled and then to the containers from which the liquid is to be emptied. The latter connection must be at a point away from the opening from which the liquid is to be discharged.
 - No Class 3 Flammable liquid shall be unloaded or loaded with the engine running unless the vehicle engine is used for the operation of the pump.

13. Class 4 Flammable Solids and Class 5 Oxidizing Materials shall be handled as follows:

- Lading shall be entirely within and covered by the body of the vehicle or by tarpaulins or by other suitable means and the tailgate or door shall be securely closed and fastened.
- Commodities which are susceptible to heat or spontaneous combustion shall be loaded in such a manner as to insure adequate ventilation between packages.
- Extra precautions shall be taken to prevent wetting of Class 4 Flammable solids and Class 5 Oxidizing materials which become more hazardous when wet.

14. Class 8 Corrosive materials shipments shall be loaded and unloaded as follows:

- Frangible containers of acids shall be individually handled when loaded or unloaded by hand.
- Frangible containers may be loaded in tiers if the weight of the upper tiers is upon the crates or boxes enclosing the frangible packagings and not upon the frangible packagings themselves. Means must be provided to prevent shifting or the tiers and individual frangible packagings in the tiers.
- Class 8 Corrosive materials may be hauled with other lading only as permitted by the loading chart. Ready access must be provided to corrosive liquids to permit their removal.
- Nitric acid loaded in the same motor vehicle with other acids or corrosive materials in carboys must be separated from the other carboys by a 2 by 6 inch plank, set on edge, nailed across the vehicle floor. The board shall be placed a distance of at least 12 inches from the nitric acid carboys and the space between shall be filled with an incombustible absorbent material such as sand, sifted ashes, etc.

15. Class 2 Gasses loading should be conducted as follows:

Cylinders shall be securely lashed in an upright position; or loaded into racks securely attached to the motor vehicle; or packed in boxes or crates which will prevent their overturn; or loaded in horizontal position. Spec. DOT - 4L cylinders must be loaded upright and securely braced. Cylinders of liquefied hydrogen cannot be transported by common carrier. Other carriers must comply with special loading rules of DOT.

16. Loading and Unloading of Division 6.1 Poisons and Division 2.3 Poisonous Gases

- Division 2.3 Poisonous Gases or Irritating Substance may not be transported if there are any inter connecting means of any character between containers.
- No Division 2.3 Poisonous Gases or Irritating Substance may be loaded into any cargo tank.

5.6 Pre-Transport Vehicle Inspection

Driver Rules

1. Only drivers who qualify under Federal Motor Carrier Safety Regulations can handle hazardous materials.
2. Vehicles carrying hazardous materials must meet federal requirements.
3. The driver must inspect his or her vehicle before loading hazardous materials or leaving the Site. Inspection should follow the procedure set forth in ATA Form C0830 (Appendix D). The driver must check to see that the vehicle is equipped with emergency equipment - fire extinguisher, red flags, flares, fuses, electric lantern; or reflective devices. (Note 1: Vehicles transporting hazardous materials must be equipped with a fire extinguisher having an Underwriter's Laboratories rating of X 10 B:C or more. Note 2: Flame producing warning devices are prohibited on any motor vehicle transporting Class 1 Explosives, Division 1.1, 1.2, or 1.3; on any tank truck transporting Class 3 Flammable liquids; or Division 2.1 Flammable Compressed Gas whether loaded or empty; or on any motor vehicle using compressed gas as a motor fuel.)
4. Tire Inspections: The driver must inspect tires before leaving the terminal and upon his return. He must also inspect tires every two hours or 100 miles, whichever comes first, while the vehicle is placarded. If any tire is leaking or otherwise defective he must drive to the nearest safe place for repair. If a tire is "hot", the driver shall notify the terminal immediately and not move the vehicle until the defective tire has been removed.
5. Placarding: Placards must be displayed on the vehicle before it leaves the Site. There should be a supply of assorted placards in the cab of the vehicle if it is not equipped with permanent placards. All placards must be removed when the hazardous materials are unloaded, except for tank vehicles or portable tanks not yet cleaned and purged.
6. Smoking: Do not smoke when driving, loading or unloading hazardous materials, or when within 25 feet of a vehicle that is placarded.
7. Fires: Do not drive near open fires. Pass open fires only when it is positively safe to do so and there is no alternative route. Don't park within 300 feet of an open fire.
8. Routing: Avoid tunnels, narrow streets, alleys and heavily populated areas unless there is no practicable alternative route or unless pickups and deliveries must be made in the area.
9. Rail Crossings. Any cargo tank or placarded vehicle containing hazardous materials, or any vehicle carrying any amount of chlorine, must make a full stop not more than 50 feet or less than 15 feet from the nearest rail of a highway grade crossing. Stops are not required at crossings which are marked "abandoned" or "exempt", street car crossings, crossings used exclusively for industrial switching within a business district, or crossings directed by a flagman, police officer, or functioning green traffic signal. If no stop is required you must reduce speed and take due care in crossing.
10. Fueling: When fueling a placarded vehicle the engine must be off and the driver or attendant must stay at the nozzle until fueling is completed.

11. **Parking:** Vehicles transporting hazardous materials cannot be parked on or within 5 feet of the traveled portion of a public street or highway except for brief periods when the necessities of operation require the vehicle to be parked, and it is impracticable to park the vehicle in any other place.
12. **Attendance:** Vehicles containing hazardous materials, other than Class 1 Explosives, Divisions 1.1, 1.2, or 1.3 that are parked on a public street or highway or the shoulder thereof must be attended by the driver. However, the vehicle need not be attended while the driver is performing duties which are incident and necessary to his duties as operator.

A vehicle is attended when the person in charge of the vehicle is on the vehicle, awake, and not in the sleeper berth, or is within 100 feet of the vehicle and has it within unobstructed view.

5.7 Routes to Nearest Highway

The facility is located approximately 700 feet northwest of the corner of Whittier and Washington Boulevard on Whittier Boulevard. The nearest interstate is the 605 Freeway, approximately 2.25 miles northwest of the site. Whittier and Washington Boulevards provides the two most direct access routes from the facility to the nearest interstate. The following information should be utilized in determining the safest and most effective route from the Site to the 605 Freeway.

Whittier Boulevard - The Site is located along a frontage road that parallels Whittier Boulevard. The nearest exit from the frontage street does not allow a left hand turn onto Whittier Boulevard. Additionally, the corner of Whittier and Washington does not allow a U-turn.

If Whittier Boulevard is the preferred route, it is recommended to travel northwest on the frontage road approximately 200 yards to an exit that allows a left-hand turn. Care should be taken entering Whittier as the boulevard is a major surface street thoroughfare. Both north and south bound entrance ramps are provided from Whittier Boulevard onto the 605 Freeway.

Washington Boulevard - If Washington Boulevard is the preferred route, leave the nearest frontage road exit, make a right-hand turn, proceed to the corner of Whittier and Washington and make a right-hand turn and proceed to the 605 Freeway.

Washington Boulevard is bounded by more industrial activities and truck traffic is common place. Both north and south bound entrance ramps are provided from Washington Boulevard onto the 605 Freeway.

5.8 Emergency Procedures

In the event of accident, breakdown or other emergency the driver must follow established company procedures for protecting the scene, obtaining assistance, notifying the fleet and gather information necessary for making reports. In addition, the following procedures should be followed when hazardous materials/wastes are involved:

On The Highway

1. Do not let people congregate in the vicinity of the accident or fire unless they are authorized to engage in combatting the fire or helping to handle the accident.
2. Keep fires, flame and lighted cigarettes, cigars and pipes away from the scene.
3. Set up warning signals on the highway to prevent further accident. Emergency signals shall be used as required in DOT Safety Regulations 392.22 to 392.25. It is recommended that flame producing signals not be used when transporting hazardous materials of any type. The use of flame producing signals is specifically prohibited by the DOT for any cargo tank vehicle used for transporting flammable liquids or flammable compressed gas and for any vehicle transporting Class 1 explosives, Divisions 1.1, 1.2 or 1.3. Such signals must be placed a safe distance from vehicles, if used at all, when flammable or combustible liquids are seeping or leaking from a fuel container.
4. Prevent leaking liquids from draining onto the highway or into sewers and streams by damming up the liquid or by digging a drainage trench only if it can be performed safely.
5. Know your load. Refer to shipping papers for name and hazardous materials classification of each commodity in your unit. Give information to firemen or police in case of emergency involving your unit. If unit displays "DANGEROUS WHEN WET" placards, advise firemen of the fact that your load includes water-reactive materials.
6. Show shipping papers and manifests to emergency response personnel so they can determine the nature of the contents and plan fire fighting techniques accordingly.
7. Leaking tanks may be transported only the minimum safe distance necessary to reach a place where safe transfer of the hazardous material to another tank may be made.
8. Flammable liquid may be transferred from one container to another or from one vehicle to another on public roads in emergencies only. Containers must be bonded or grounded before and during transfer of the liquid from one container to another. Emergency signals (non-flame producing) must be set up during this operation.
9. Flammable solids and oxidizing materials should be unloaded if it will decrease the fire and other hazards. Broken boxes and loose materials should be gathered and disposed.

Vehicle Break Downs

1. Emergency signals shall be used as required in rules 392.22 to 392.25 of the DOT Safety Regulations.
2. Special effort should be made to remove the vehicle to a place where the hazards of the load being transported may be protected against exposure.
3. Repair and maintenance of vehicles transporting hazardous materials are subject to the following restrictions:
 - a) Except for a vehicle placarded COMBUSTIBLE, heat-producing repairs may not be made on the fuel or cargo containment systems of any placarded vehicle; e.g. welding or cutting could be done on a spring shackle, but not on the door of a van.
 - b) Repair and maintenance on a placarded vehicle (except one placarded COMBUSTIBLE) may be made in a garage or closed space only under the following conditions:
 - i) The cargo containment and fuel containment systems are closed (except as necessary to run the engine);
 - ii) Provision must be made for immediate removal of the vehicle in case of emergency;
 - iii) The vehicle must be removed from the building on completion of the work;
 - iv) If the vehicle is transporting Division 1 .1, 1.2, or 1.3 explosives, flammable liquid or flammable gas, all sources of spark, flame or glowing heat in the enclosure (including a heat system drawing air from the enclosure) must be shut down or made explosion-proof by an acceptable method. This does not apply to the electrical system of the vehicle if its use is necessary in connection with the maintenance or repair.
 - c) No heat-producing repair may be made on a cargo tank used for flammable liquids or gases, or poisonous liquids, or on a fuel tank of any type unless the tank, or any compartment has first been made gas-free.

Emergency Assistance, Accidents And Incidents

1. If hazardous materials on a vehicle are found to be leaking, damaged, on fire or have any appearance of being in unsafe condition the driver should notify the fleet safety director or a responsible individual as quickly as possible under the circumstances. He or she must not leave his or her vehicle to make such a notification unless there is no danger to the general public or unless the vehicle is under guard by a responsible individual. It may be necessary to have another person make such notification while the driver stays with the vehicle.
2. If a vehicle transporting hazardous materials is involved in an accident, the driver should ascertain if the hazardous materials have been damaged or if it appears that such materials may become involved for any other reason such as fire in the wreckage. After he or she has taken the necessary steps to protect the scene and the public he or she should contact his or her fleet as outlined above.

Required Notification for Hazardous Material, Hazardous Waste or Hazardous Substances Incidents (spills, leaks, discharges, etc.)

Whenever there is a spillage or leakage of hazardous materials, including hazardous wastes and hazardous substances in a vehicle, or there is direct involvement of the hazardous materials arising out of a motor vehicle accident, special reports must be made in accordance with the following:

IMMEDIATE NOTICE OF CERTAIN HAZARDOUS MATERIALS INCIDENTS (49 CFR, 171.15)

- (1) A call to the DOT National Response Center must be made as promptly as possible if an incident involves hazardous materials during transportation, loading, unloading or storage and results in one or more of the following:

- Death of any person(s).
- Injury requiring hospitalization of any person(s).
- Estimated damage to carrier or other property exceeding \$50,000.
- An evacuation of the general public occurs lasting one or more hours.
- One or more major transportation arteries or facilities are closed or shut down for one hour or more.
- Fire, breakage, spillage or suspected radioactive contamination involving a shipment of radioactive materials.
- Fire, breakage, spillage or suspected contamination involving a shipment of etiologic agents.
- In the judgement of the carrier there exists a situation which should be reported even though it does not meet one of the specific criteria listed above.

SPECIAL DOT PHONE NUMBERS (National Response Center): Nationwide, 1-800-424-8802; Washington, D.C. Metropolitan Area, 202-426-2675.

- (2) In making a telephone report, the following information must be provided to the extent that it is available:

- Name of reporter
- Name and address of carrier represented by reporter
- Phone number where reporter can be contacted
- Date, time and location of incident
- Extent of injuries, if any
- Classification, name and quantity of hazardous materials involved
- Type of incident, nature of hazardous materials involvement, and whether or not there is a continuing danger to life at the scene.

DETAILED HAZARDOUS MATERIALS INCIDENT REPORTS (49 CFR, 171.16)

- (1) A written report must be made within 15 days of discovery of an incident arising out of the transportation, loading, unloading or storage of hazardous materials as follows:
 - As a follow-up to any such incident reported by phone in accordance with the criteria set forth, above.
 - As the result of an unintentional release of hazardous materials from any packaging including a cargo tank.
 - As the result of release of any amount of hazardous waste.
- (2) The report in duplicate shall be sent to:

Information Systems Manager
Research & Special Programs Administration
U. S. Dept. of Transportation
Washington, D.C. 20590

The report shall be made on the prescribed form DOT F-5800.1 available from American Trucking Associations, as form C0670.

- (3) The filing of a Hazardous Materials Incident Report does not relieve the interstate carrier from the necessity of also filing an MCS 50T report with the Regional Motor Carrier Safety Office, if the hazardous materials incident arises out of a motor vehicle accident.
- (4) In filing a Hazardous Materials Incident Report, the carrier should endeavor to provide all of the information required to complete the report and to provide as much information as possible about the incident. These reports are analyzed by DOT to discover unsafe or inefficient packagings of hazardous materials, and to make such changes in the hazardous materials regulations as experience indicates are necessary for safety.
- (5) For reports of hazardous waste discharges a copy of the hazardous waste manifest must be attached to the written report.
- (6) The filing of the reports mentioned above does not relieve a carrier from the responsibility to report spillages of hazardous materials, or spillages of other materials that may create a pollution problem to local, state and federal agencies concerned with environmental controls as required in the area where any such spillage occurs.

HAZARDOUS SUBSTANCE DISCHARGE NOTIFICATION (49 CFR, 171.17)

- (1) Any release of hazardous substances or hazardous wastes must be reported to the U.S. Coast Guard National Response Center at (toll free) 800-424-8802 or 202-426-2675. (Note: Only spills of hazardous substances which equal or exceed the designated reportable quantity are required to be reported, however, it is recommended that all spills be reported.)
- (2) The report must be made by either the driver or a company official as soon as that person has knowledge of the discharge.

- (3) The discharge notification should include:
 - (a) The information listed in (2) above;
 - (b) The name of the shipper; and
 - (c) The quantity of hazardous substance discharged, if known.

There are severe penalties for failure to make these reports.

- (4) Releases of reportable quantities of an extremely hazardous waste or CERCLA hazardous substance listed in Title 40, Part 355, section 355.40, when they occur in transportation or storage incidental to transportation must be immediately reported to the local emergency planning committee, or if none available to the state emergency planning commission, or as a last resort by dialing 911 or calling the operator.

5.9 Waste Disposal

Waste disposal options include the direct transportation of wastes to ENSCO's incineration facility. ENSCO's incineration facility is a Part B permitted RCRA facility, located in El Dorado, Arkansas, and is capable of storing approximately 31,000 drums. The facility can accept 55-gallon steel drums as well as all DOT-approved containers. Certificates of Destruction will be provided for all waste shipments that are incinerated.

Alternative TSDFs may be used if they are determined to be more appropriate than the proposed disposal facility. The most appropriate disposal facility will be determined based on the type of waste, hazardous classification, cost of disposal, and regulatory status of the waste facility. The determination of the appropriate disposal facility will be made onsite as the wastes are being characterized. Alternatively, if the waste is transported to a transfer facility, determination of the most appropriate disposal facility will be made once the waste has reached the transfer facility and disposal options have been explored. All TSDFs will be approved to accept CERCLA wastes.

6.0 SAMPLING AND ANALYSIS PLAN

This SAP has been prepared for the removal of approximately 3,000 drums of unknown chemicals, the decontamination of five AST's, five distillation columns, two evaporators, one sump, two drum storage pads, and other equipment identified onsite as having been impacted by former operations conducted at the Site.

6.1 Purpose and Scope

The purpose of this SAP is to define project activities necessary to ensure that field activities performed and data generated during the removal of the drums at the Site are technically valid and adequate to document the removal actions. This SAP specifies the requirements and procedures for field sampling, hazard and characterization, and laboratory analysis to be conducted and is intended to serve as a guidance document for use in the field at the Site. The QAPP Section 7.0, is referenced throughout the SAP and is intended to serve as an additional guidance.

The sampling procedures specify the sampling rationale, procedures, and related field operations for the drum removal and decontamination of onsite equipment and structures impacted by former operations conducted onsite. The DCQAP specifies sampling and analysis QA/QC requirements for this project.

6.2 Approach

The overall strategy of the SAP is to properly manage, transport and dispose of the drums by determining the hazards associated with each drum contents. Additionally, the SAP is designed to determine the basic waste characteristics of each drum's contents to determine safe, effective, and efficient disposal options.

The SAP consists of the following three steps:

1. Field sampling,
2. Hazard characterization,
3. Laboratory sampling, if necessary.

Each drum will be field screened utilizing the HazCat® procedures discussed in Section 6.4. The HazCat® procedure will identify the hazards associated with the drum contents and allow for the proper labeling, transportation, and disposal of the drum contents.

If the HazCat® of the drum contents is inconclusive, inconsistent, or of concern to the field chemist, samples will be collected as described in Section 6.3 and transferred to a state-certified laboratory for hazardous waste characterization.

6.3 Field Sampling Procedures

The first step in sampling is to open the bung or drum head on the drum.

The second step in sampling will be to screen the drum by visual observation and use of a photoionization detector (PID)/flame ionization detector (FID). The drum number and the PID/FID readings and observations should be noted in a field log book.

Samples for hazard characterization will be collected from all drums containing liquid or solid. A total of approximately 3,000 drums will be sampled. For each sample collected, the drum numbers from which material is collected will be recorded.

The method of sample collection will depend on the prevailing weather conditions and condition of the solid material. It is anticipated that one of the following sampling methodologies will be employed to obtain a representative sample from each drum. Sampling equipment will be decontaminated before samples are collected, or disposable sampling equipment will be utilized, and placed in drums after use for disposal as investigation-derived waste (IDW).

The sampling procedures to be used to obtain a representative sample of the waste - Sampling methods and equipment will vary with the form and consistency of the waste materials to be sampled; however, sampling will be conducted in accordance with "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods." Sampling strategy is outlined in Tables 6.1. Table 6.1 defines recommended sampling equipment and corresponding limitations. This strategy is a suggested guideline but actual methods used will depend on the particular situation.

Transfer the sample to the HazCat® area.

TABLE 6.1
SAMPLERS RECOMMENDED FOR VARIOUS TYPES OF WASTES

Waste Type	Recommended Sampler	Limitations
Liquids, sludges, and slurries in drums, vacuum trucks, barrels, tank trucks, and similar	COLIWASA a) Plastic b) Glass c) Stainless steel, etc.	Not for containers greater than 2.5 m deep. Not for wastes containing ketones, nitrobenzene, dimethylformamide, mesityl oxide, or tetrahydrofuran Not for wastes containing hydrofluoric acid and concentrated alkali solutions. Not for wastes with HCl, HNO ₃ .
Powdered or granular solids in bags, drums, barrels, and similar containers	a) Grain sampler b) Sampling trier	Limited application for sampling moist and sticky solids with a diameter 0.6 cm (¼") May incur difficulty in retaining core sample of very dry granular materials during sampling.
Dry wastes in shallow containers	Trowel or scoop	Not applicable to sampling deeper than 8 cm (3"). Difficult to obtain reproducible mass of samples.
Solids deeper than 8 cm (3")	a) Soil auger b) Veihmeyer sampler	Does not collect undisturbed core sample. Difficult to use on stony, rocky, or very wet soil.
Wastes in storage tanks	Weighted bottle sampler	May be difficult to use on very viscous liquids.

6.4 HazCat® Procedures

HazCat® procedures will consist of the following:

- A small sample of the unknown substance will be placed on a watch glass.
- The substance will be examined to determine if it is reacting with the air. Signs of heat or vapors being evolved will be noted.
- A small quantity of water will be placed on the sample using a pipet. The sample will be examined for signs of reactions.
- The pH of the sample will be tested by wetting the pH paper with the water on the watch glass.
- The sample will be tested with oxidizer paper and watched for any color change in the paper.
- The sample will be tested for cyanide using a draeger tube specific for cyanide. Any change in the color of the tube will be noted. If a color change is noted, the following procedures will be stopped and we will refer to the Sensidyne manual for further tests.
- A small quantity of hydrochloric acid (0.1N) will be added to the sample. The sample will be watched for any signs of reaction.
- The sample will be tested for sulfides by touching the sample with sulfide paper. Any color change will be noted.
- A small piece of wire will be heated and touched on a small part of the unknown.
- A new sample of the unknown will be placed on the watch glass and a burning match will slowly be moved under the watch glass. If the sample burns and how vigorously it burns will be noted. Samples that burn quickly with a strong flame will be classified as Flammable (Class 3).
- A small sample of unknown will be placed in a test tube and a char test will be performed. The Btu content will be estimated based on the flammability of the vapors given off and the residual ash left after the test.
- The hot wire test will be performed on the sample by dipping a bare copper wire in the sample and heating the wire with a propane torch. A green flame is a positive for chlorine. The chlorine will be estimated by the extent of the green flame.

6.5 Laboratory Analysis

If the hazard characterization results are inconclusive, inconsistent, or of concern to the field chemist, samples will be taken to a state-certified laboratory for analysis. Samples will be collected as described in Section 6.3. The following steps will be utilized to ensure the samples collected are properly identified and transported and that the requested analyses are performed.

Sample Labels. Sample labels are required for all samples. Site- and time-dependent information will be added to the labels using indelible ink. The labels will be protected from water and solvents with clear tape. Each label will contain the following information:

- Project name
- Name of collector
- Date and time of collection
- Sample number
- Preservative (if any)
- Method of analysis

Sample Identification System. A sample identification system will be used in the field to identify each sample collected during the sampling program. This coding system will provide a tracking record to allow retrieval of information about a particular sample and ensure that each sample is uniquely identified. Each sample will be identified by a unique code that indicates the site number, sample type, sample point, and sequence number.

Chain-of-Custody. Sample possession will be documented through the use of a chain-of-custody (COC) record. The COC will be used to document the integrity (i.e., quality) of samples during collection, transportation, analysis, and reporting. The possession of the samples will be traceable from the time samples are collected until the analyses are reported by the laboratory.

Each sample label and COC form will contain the following information:

1. Sample site type, which describes the nature of the media sampled (COC only)
2. Site identification (ID), which is keyed into a location by an alphanumeric code or a descriptive title
3. Sampling date
4. Time of sample collection, in 24-hour clock designation
5. Sampling technique
6. Name and signature of personnel responsible for sample collection
7. Specific name of the chemical or physical analysis to be performed
8. Project name (COC only)
9. Airbill number (COC only)

10. Laboratory ID (COC only)
11. Sample label or tag number
12. Preservation technique used and whether sample has been filtered

A sample label will be placed on the sample container before sample collection, when possible. The necessary information will be written on the label in permanent ink before sample collection, and the label will be secured to the container. All sample information recorded in the field will also be copied onto the COC before sealing the shipping cooler.

Samples will remain in the HLA Site Supervisor's custody or control following sample collection. The Site Supervisor will inspect each COC form to ensure it is accurate and legible before being released for transport to the laboratory. If necessary, a hazardous materials label will be placed on a readily visible portion of the sample cooler to warn transportation personnel of its contents. Individuals relinquishing custody or receiving custody will sign, date, and record the time on the COC form or airbill, if applicable. Copies of the COC form and airbill will be placed inside the sample cooler (at 4°C) in a tamper-proof envelope taped in place. The coolers will then be sealed with evidence tape. The courier will obtain custody of the samples through the airbill or shipping bill.

Transportation of Samples to Laboratory. All samples will be accompanied by a COC form. When transferring samples, the HLA field representative relinquishing and the individual receiving the sample(s) will sign and date the chain of custody form. When samples are shipped to Del Mar Analytical for analysis, the COC form will accompany each shipment and the method of shipment, courier name(s), and other pertinent information will be entered on the. A copy will be retained at the file or project office.

Laboratory Analysis. Upon receipt of samples by the laboratory, each field sample will be noted on a laboratory logsheet. The sample log-in clerk will physically apply a unique laboratory sample number to each sample. If sample tags are received with the samples, the laboratory sample number will also be applied to these. Care will be taken to ensure that the sample number does not interfere with information recorded on the sample label.

6.6 Decontamination Procedures for Sampling Equipment

Reusable sampling equipment that contacts drum contents will be decontaminated before each use. Decontamination will consist of Alconox wash or potable and deionized water rinses, as appropriate.

- Before individual sample collection, the equipment will be cleaned in an Alconox solution, rinsed with potable water, and rinsed with deionized water.
- All sampling equipment will be allowed to air dry before reuse.
- Clean sample containers will be provided as needed.

6.7 Calibration Procedures

The analytical instruments will be calibrated for target analytes in accordance with the required analytical method. The initial calibrations, continuing calibrations, and calibration evaluation will be performed and calculated in accordance with the methods outlined in Appendix E, Instrument Calibration Procedures.

The field logs and sample record logs are discussed below.

6.8 Documentation Control

All project files will be maintained by the HLA Project Manager. All documents will be kept in project files in the field office and in HLA's Santa Ana, California office.

7.0 DATA COLLECTION QUALITY ASSURANCE PLAN

7.1 Project Description

The DCQAP has been prepared to address the collection of scientifically sound and defensible data for the removal of approximately 3,000 drums, decontamination of five ASTs, five distillation columns, two evaporators, one sump, and two storage pads at the Omega Site in Whittier, California. Adherence to this plan will ensure that the data collected by HLA are documented and of known precision, accuracy, and completeness.

This DCQAP is applicable to all HLA activities and to the management of HLA subcontractor activities in the collection and evaluation of data. The data quality objectives for the removal action are: (1) to remove approximately 3,000 drums at the site; (2) to identify the hazardous characteristics of the drums' contents; and (3) to present data that can be legally defended in a court of law.

In order to accomplish the preceding objectives, this DCQAP is designed to implement specific project procedures necessary to maintain an acceptable level of quality of technical results. This DCQAP including QC procedures and the Work Plan (Section 4.0) has been developed to meet the applicable quality guidelines of the following documents:

- EPA *Quality Assurance/Quality Control Guidance for Removal Activities under CERCLA* (April 1990)
- EPA *Users Guide to the Contract Laboratory Program* (December 1986)

The DCQAP and the Work Plan specify appropriate controls, responsibilities, and records requirements for observations, sample collection, and measurements. Project procedures relevant to this project and referenced in this DCQAP are contained in the Work Plan.

A complete description of the location, size, important features, and chronological history of the Site has been provided in Sections 1.2 and 1.3 of this Plan.

7.2 Project Organization and Responsibilities

Project organization and key personnel applied to each project task are outlined in Section 2.0; Organization Responsibilities and Contacts.

7.3 Quality Assurance Objectives For Measurement

The overall QA objectives are to develop and implement procedures for obtaining and evaluating data in an accurate, precise, and complete manner so that analytical data, sampling procedures, and field characterization provide information that is internally comparable and representative of actual field conditions. Furthermore, it is an objective of the QA program that data collection procedures will be sufficiently documented so that data are traceable and legally defensible in a court of law.

This DCQAP establishes procedures necessary to produce technical products of consistent quality. This uniformity will be accomplished through the formal standardization and documentation of field and laboratory techniques and activities. In addition, project deliverables will be distributed and reviewed in accordance with specific guidelines. All field and laboratory activities will be coordinated and reviewed to ensure consistency with overall project objectives. Actual field and laboratory activities will be performed by properly trained and qualified personnel and will conform to specific procedures outlined in this DCQAP and the Field Sampling Plan (Section 6.0).

Project deliverables resulting from these activities will be submitted to QA personnel to be reviewed for accuracy, precision, completeness, comparability, and representativeness. The definitions of these terms are as follows:

- Accuracy - The degree of agreement of a measurement with an accepted reference or true value.
- Precision - A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Usually expressed in terms of the standard deviation.
- Completeness - The amount of valid data obtained from a measurement system compared to the amount that was expected and needed to be obtained to meet the project data goals.
- Comparability - Expresses the confidence with which one data set can be compared to another.

- Representativeness - Refers to a sample or group of samples that reflects the characteristics of the media at the sampling point. It also includes how well the sampling point represents the actual parameter variations that are under study.

Project goals for accuracy and precision are established for the results of chemical analyses of field and laboratory QC samples. Refer to the Quality Assurance Program included in Appendix F. These goals have been subdivided by sample medium and analytical method. The goals are consistent with the standard QA/QC goals referenced for each method. If precision and accuracy goals are not specified for an analytical method in the respective published manuals, laboratory-defined criteria will be adopted. The actual precision and accuracy of the chemical analysis results will be calculated using the analytical results of field and laboratory QC samples specified in Section 7.8 and using Appendix F.

As the attainment of project precision and accuracy goals is reviewed, project goals may be revised to address site- and media-specific concerns. Such site- and media-specific QC goals may be developed, for example, in cases where complex sample matrices and sample heterogeneity prevent attainment of original precision and accuracy goals for laboratory and field QC samples.

Comparable data are obtained by consistently using standard analytical and characterization methods and standard sampling procedures, and by reporting all values in consistent units. For example, no mixtures of standard and metric units will be reported for depths, distances, elevations, etc. Results of standard and nonstandard analyses will not be compared without taking into account the potential influence of differences in methodology on sample results.

Representative data are obtained by following proper and consistent procedures for sample collection and as well as application of approved standard analytical methods. Additionally, the sampling points will adequately reflect the characteristics of the medium that is sampled.

In striving to meet the QA objectives outlined above, HLA will implement data reduction and validation procedures described in Section 7.8. QC measurements for these activities are addressed in Appendix F.

In the event of a "nonconforming" item occurrence (an occurrence that could render the quality of an item or activity unacceptable or indeterminate with respect to specific requirements), a nonconformance report will be initiated and processed in accordance with Appendix F. This procedure addresses the identification, documentation, segregation, tracking, review, approval, disposition, and notification of affected organizations concerning nonconforming items and activities. If deemed necessary, corrective action, in accordance with Section 7.13, will also be initiated.

7.4 Sampling Procedures and Field Measurements

Sampling procedures are described in detail in the SAP Field Sampling Plan (FSP) Section 6.0. The FSP provides a general description of collection and preservation methods; sample storage, shipping, and sample custody; analytical test methods; and the sample identification system.

Field parameters will be measured using instruments that have been calibrated and are operated according to the manufacturers' guidelines and recommendations. Field measurements will be recorded by a qualified HLA engineer/scientist who has been trained in the use and calibration of each instrument.

7.5 Sample Custody

To comply with the guidelines outlined in the EPA *Users Guide to the Contract Laboratory Program*, sample possession must be documented. Because samples collected during any investigation could be used as evidence in a court of law, their possession must be traceable from the time the samples are collected until they are introduced as evidence in legal proceedings. To document sample possession, chain-of-custody (COC) procedures will be followed.

In collecting samples for evidence, enough of a quantity will be collected to provide a good representation of the medium being sampled. Quantities of samples collected are predetermined by the test method for the particular analyte of interest.

The Site Chemist and the Site Supervisor will be responsible for the custody of the samples collected until they are transferred or properly dispatched. The Site Supervisor will assess whether proper custody procedures were followed during the field work and will decide if additional sample collection is required.

Samples will be accompanied by a COC record. During transfer, individuals relinquishing and receiving the samples will sign, date, and note the time on the record. The COC form will document the sample custody transfer from the sampler, through a courier, to the laboratory.

- Samples will be packaged properly for shipment and dispatched to the Del Mar Analytical Laboratory for analysis, with a separate chain-of-custody record accompanying each shipment. A copy of the COC record will be retained in the project files.

- Del Mar Analytical Laboratory will accept custody of the shipped samples and verify that the information on the sample identification tags matches that on the COC records.
- Del Mar Laboratory will use the sample identification number or assign a unique laboratory number to each sample, and ensure that all samples are transferred to the proper analyst or stored in the appropriate secure area.
- Del Mar's laboratory custodian will distribute samples to the appropriate analysts. Laboratory personnel will be responsible for the care and custody of samples from the time they are received until the sample is either exhausted or is returned to the custodian.

7.6 Calibration Procedures

The equipment used in collecting field data will include a variety of instruments. Proper maintenance, calibration, and operation of each instrument will be the responsibility of the HLA personnel assigned to each task. Instruments and equipment used during the study will be maintained, calibrated, documented for calibration, and operated according to the manufacturers' guidelines and recommendations. A list of instruments requiring calibration will be maintained for the duration of the study in a calibration notebook (see Exhibit A). A record of all instrument calibration activities also will be maintained in a Site calibration notebook. Any required service, repairs, or replaced parts will be noted.

If an instrument is found, upon calibration, to have been used when it was out of calibration limits (to the extent that resultant data would be invalid), the occurrence will be considered unusual and subject to corrective action in accordance with Section 7.13.

Laboratory calibration procedures will be conducted in accordance with the approved EPA QA/QC guidelines and laboratory policies.

7.7 Analytical Procedures

In general, Del Mar Analytical will adhere to those recommendations promulgated in Title 21, Code of Federal Regulations, CFR Part 58, *Good Laboratory Practices*; criteria described in *Methods for Chemical Analysis of Water and Wastes* (EPA, 1979; EPA-600/4-79-202); and requirements outlined in *Users Guide to the Contract Laboratory Program* (EPA, 1986). Physical testing will be conducted in accordance with American Society for Testing and Materials standards (Annual Book of ASTM Standards, 1994).

7.8 Data Reduction, Validation, and Reporting

Quality assessment of the analytical data will adhere to the procedures in the EPA *Users Guide to the EPA Contract Laboratory Program* for analysis of chemical data. These procedures specify the documentation needed and the technical criteria required to complete QA/QC of the data.

Validation of laboratory data will be performed by HLA specialists in analytical chemistry or physical testing and will adhere to the guidelines presented in the draft document *Scientific and Technical Standards for Hazardous Waste Sites* (California Department of Health Services [DHS], 1990). The laboratory will be required to submit results that are supported by sufficient backup data and QA/QC results to enable the reviewer to conclusively determine the validity of the data.

Validation of all data obtained from field measurements will be performed by qualified field personnel. Validation will be performed by checking calibration procedures utilized in the field and by comparing the data to previous measurements obtained at the specific site.

The Quality Assurance Officer (QAO) will check the data sets to ensure that QC was performed in accordance with the DCQAP.

7.9 Internal Quality Control

QC consists of specific checking, examination, and inspection as described in the procedures for field data collection, sample collection, and analysis. Documentation of QC actions is provided on field logs, data reports, related records or documents, and correspondence, all of which are then filed and maintained in the controlled project file.

7.10 Performance and System Audits

Field and office activities will be monitored and periodically audited by the QAO to evaluate the implementation effectiveness of the project QA program to produce reliable sampling and field measurement data.

Audit reports will be issued to the Project Manager with copies to the HLA Program Manager. Field audits will evaluate the execution of sample collection, sample identification, sample control, COC, field documentation, instrument calibration, field measurement, and data acquisition procedures. Office

audits will evaluate data reduction and management activities, project record completeness and retrievability, and conformance to procedures for the issuance of all work products.

The initial audits will be conducted at both the office and the Site beginning at the inception of onsite activities in order to evaluate implementation of the DCQAP and project procedures.

It is not currently anticipated that audits of analytical laboratories will be necessary. However, the selected laboratory will be required to provide documentation of state certification. If inconsistencies or performance aberrations are noted during routine analytical data assessment and inspection, corrective action may be required (Section 7.13).

7.11 Preventive Maintenance

All instruments and equipment will receive routine preventive maintenance, which will be recorded in instrument-specific maintenance logs. At a minimum, all instruments will be inspected for usable condition and calibration status prior to field use.

Laboratory instruments will be maintained according to the QA/QC plan established by the laboratory. Calibration and maintenance will be performed in accordance with approved EPA calibration and maintenance checks.

7.12 Specific Routine Procedures to Assess Data

Chemical data will be validated according to accuracy, precision, and completeness for both the field and analytical laboratory programs. The primary goal of the programs is to ensure that the data reported are representative of conditions onsite. To meet this goal, a combination of statistical procedures and qualitative evaluations will be used to check data quality. If problems arise and the data are found to deviate from previous analyses or analyses of surrounding conditions, the data will be annotated rather than removed from the database. Repetition of sample collection and analysis will be used only in extreme cases of QC problems.

7.13 Corrective Actions

The need for corrective action may be identified during QC review of data and reports, during field and office audits, or during QA monitoring of activities. Identification, correction, verification, and documentation of corrective actions so identified are controlled by the appropriate sections of this

DCQAP. Laboratory nonconformance may be noted during routine analytical data assessment and inspection. In such instances, the laboratory, QAO, and appropriate technical specialist will discuss the situation, and a corrective action report (CAR) will be prepared documenting the corrective action to be implemented (see Exhibit C). If necessary, HLA will perform an audit of the laboratory to confirm that corrective actions are implemented and are appropriate. The CAR will be distributed to the project file, Project Manager, and QAO.

During performance of a field investigation, the predictability of field conditions is limited. If conditions are encountered that are outside or contrary to those anticipated in project planning and not provided for or contrary to field investigation procedures, affected work will be stopped. The Task Managers or Project Manager will be immediately consulted, and their decision will be followed concerning direction of work. Any such deviation from approved procedures will be documented in field notebooks, and a CAR will be prepared. The involved Task Managers or Project Manager will be responsible for preparing and processing the CAR. The cause and actions to prevent recurrence will be approved by the project manager and the QAO. The QAO will verify completion of all actions required by the CAR. If appropriate, data sheets will be annotated. The CAR will be distributed to the project file, Project Manager, and QAO.

7.14 Quality Assurance Reports

The QAO will issue periodic QA activity reports to the Project Manager with copies to the HLA Program Manager. These reports will identify any audits conducted, audit findings, and finding resolution status. In addition, QA reports will include results of QA activities, i.e., assessments of measurement data accuracy, precision, and completeness; QA surveillance; and any corrective action items.

The Phase I report will include a QA section. A summary of the QA program results and quality of generated data will be discussed in this QA section.

EXHIBIT A



LIST OF INSTRUMENTS REQUIRING CALIBRATION

29682\BFS001RP.apc

EXHIBIT B



CALIBRATION RECORD

INSTRUMENT				DATE CALIBRATED		NEXT CALIBRATION DUE	
ID NO.	DESCRIPTION						
CALIBRATION STANDARD:				CALIBRATED BY:			
AS-FOUND CONDITION				CALIBRATION DATA			
COMMENTS:							
NAME:				SITE:			

INSTRUMENT				DATE CALIBRATED		NEXT CALIBRATION DUE	
ID NO.	DESCRIPTION						
CALIBRATION STANDARD:				CALIBRATED BY:			
AS-FOUND CONDITION				CALIBRATION DATA			
COMMENTS:							
NAME:				SITE:			

INSTRUMENT				DATE CALIBRATED		NEXT CALIBRATION DUE	
ID NO.	DESCRIPTION						
CALIBRATION STANDARD:				CALIBRATED BY:			
AS-FOUND CONDITION				CALIBRATION DATA			
COMMENTS:							
NAME:				SITE:			

EXHIBIT C



CORRECTIVE ACTION REPORT

1. Project Number	2. Project Name	3. CAR Identification Number	
4. Responsible Manager	5. Date	6. Personnel Involved	
7. Reference Document(s)			
8. Unusual Occurrence or Unexpected Event Description			
9. Cause Determination			
10. Corrective Action to Preclude Recurrence			
11. Schedule Date	12. Approval (PM & QAO)	13. Completion Date	14. Submitted by
15. VERIFICATION Actions: By QAO: _____ Date: _____			

8.0 CONTINGENCY PLAN

8.1 Contingency Plan

This Contingency Plan has been developed by HLA to present procedures that should be followed in the event of an emergency at the Site. A variety of events that are potential hazards to human health and the environment are discussed, including the following:

- An explosion or fire
- A chemical or petroleum spill or accident
- Other events presenting a hazard to human health or the environment

This section also specifies the general procedures should be followed, who should be notified, and the information that should be reported for the first person on the scene of an emergency.

8.2 Response Sequence for First Arrivals

If you are first on the scene, respond as follows:

1. Evacuate the incident area (if necessary). Rescue injured personnel and provide first aid as necessary. Remember that your safety must be the primary consideration.
2. Restrict access to the incident area.
3. Restrict the use of ignition sources for incidents involving flammable substances.
4. Call the Site Supervisor or the appropriate local emergency response organization (e.g., paramedics, fire department). Report the following information:
 - Your name
 - Company affiliation
 - Telephone number from which you are calling
 - Location and type of incident
 - Injuries, if any, and the number and type of those injuries
 - Details concerning the substance(s) involved (identification, amount, spill rate, size of area involved), if known

- Direction the spill is moving and the direction the wind may be dispersing airborne contaminants
 - Surficial material on which the spill occurred (e.g., asphalt, gravel)
 - Any first response action that has been taken
 - The time the incident occurred or when you discovered it
 - Any additional pertinent information
5. Notify the SSHO after the emergency response team has been contacted. The SSHO will then notify the local DSHO.
 6. Coordinate with emergency response personnel when they arrive.

8.3 Response for Incidents Involving Another Contractor

If the incident involves another contractor's activity:

- Initiate steps 1 through 4 under Section 8.2.
- Decontaminate and remove PPE if the incident is not life- or health-threatening.
- Proceed to the predetermined assembly point.
- Make sure the SSHO knows you are present.

8.4 Emergency Response for Severe Weather Conditions

This section specifies what you should do in the event of a severe weather emergency, including electrical storms, high winds, and heavy rain or hail.

Electrical Storms

- Seek shelter at the support facility or in the field vehicles.
- Do not stand near or under high objects, such as trees and drilling rigs.
- If possible, lower the drilling rig mast.

High Winds

- Seek shelter at the support facility (if anchored) or in the field vehicles.

- Do not drive high-profile vehicles at high speeds.
- Park vehicles heading into the wind.
- If blowing dust is a hazard, don a respirator or wear safety goggles and a kerchief covering your nose and mouth.

Heavy Rain or Hail

- Seek shelter at the support facility or in the field vehicles.
- Do not attempt to drive a vehicle if you are in an area that is flooding or has the potential for flooding unless you are moving out of a low area.

8.5 Emergency Response for Earthquakes**Inside**

If an earthquake occurs while you are in a building, follow these instructions:

- Stand in an interior doorway or get under a desk or table.
- Stay away from areas containing a large amount of glass.
- Do not use stairways or elevators during the tremor.
- If possible, turn off gas supplies and ignition sources.
- Be aware of the potential for live downed wires.
- Make sure the telephone handset is on the hook. Do not use the telephone for non -emergency calls.
- Evacuate the building when the tremors have ceased. Be aware of the potential for aftershocks.
- Walk briskly. Do not run. Do not pick up personal items.

- Report to a predetermined assembly area and notify your supervisor or the area monitor that you are safe.
- Report missing persons.

Outside

If an earthquake occurs while you are outside, follow these instructions:

- Avoid buildings, trees, areas with large amounts of glass, and power lines.
- Avoid downed wires.
- If operating heavy equipment or a motor vehicle, stop immediately but stay in the vehicle until the tremors have stopped.
- If operating a motor vehicle on a bridge, proceed to solid ground if the end of the bridge is close.
- If operating a motor vehicle on a bridge at mid-span, get out of the vehicle and begin walking to the nearest solid ground.

8.6 Emergency Response for Flash Floods

If a flash flood warning is issued, climb to higher ground. Seek shelter on stable ground. Do not stay in an area that is characterized by uncompacted material on a steep slope.

8.7 Emergency Response for Fires

If a small fire occurs, extinguish it with the fire extinguisher in the field vehicle. Remember to follow these directions to put out the fire:

- Aim at the base of the flame.

- Use the appropriate type of fire extinguisher (e.g., do not use a water-type fire extinguisher or an electrical fire).
- Remember that the spray only lasts a few seconds.

If a large fire occurs at the work site, follow these instructions:

- Move flammable and combustible items out of the path of the fire, only if such action can be performed safely.
- Call the fire department and report the information outlined under Section 8.2, step 4.
- Do not attempt to put out a large fire with the field vehicle fire extinguisher.
- Report the incident to the Site Supervisor.

8.8 Fire Prevention

Steps to be taken to minimize the potential of a fire include the following:

- Obey "No Smoking" signs.
- Label and store flammable liquid containers in a protected, ventilated, and approved area.
- Use only approved containers for flammable liquid storage.
- Use minimum amounts of flammable liquids.
- Shut off engines before refueling, if possible.
- Do not refuel a hot engine unless an ABC-rated fire extinguisher is nearby.
- Store oily rags in a self-closing metal container. Dispose of containers properly.

- Bond and ground all flammable liquid containers and transfer equipment when transferring or filling product.
- Use intrinsically safe equipment in areas potentially containing flammable vapor.

8.9 Emergency Response for Explosions

If an explosion occurs, follow these instructions:

- Initiate steps 1 through 4 under Section 8.2.
- If feasible, decontaminate yourself and others.
- Do not address medical emergencies until you are out of danger.
- Call the Site Supervisor or local emergency response organization when you are out of danger to report the incident.

8.10 Emergency Response for Spills

The following sections provide guidance regarding emergency response to a chemical spill including initial response to the incident and cleanup. Precautions you should take to minimize the likelihood of a spill are presented at the end of this section.

8.11 Initial Spill Response

When a spill occurs:

- Minimize or contain the flow by shutting off a valve, repairing the leak, righting an overturned barrel, or whatever action is appropriate. Remember that your safety is of primary concern. Only attempt emergency response actions if you can do so without injury or harm to yourself.
- Provide first aid to injured persons as needed.
- If the spill occurs on a porous surface (e.g., soil, gravel) mark the area so that samples may be taken to determine the area of impact. If the spill occurs on concrete, asphalt, or similar material, use sorbent material to contain the spill. Sorbent materials will be kept in field vehicles and in the support facility. Cover the area with soil, a tarp, plastic, or other appropriate material if the spilled material is volatile and cannot be cleaned up immediately.

- Call the Site Supervisor or the local emergency response organization (as applicable) to report the incident. Supply the information listed under Section 8.2.
- Dependent on the location and chemical nature of the spilled liquid, initial response action may require donning Level C or Level B PPE.

8.12 Spill Site Decontamination

Site personnel involved in the response action will undergo limited personal decontamination upwind of the incident site. Further decontamination will be completed at the decontamination area in the support zone. The SSHO will authorize site personnel to leave the job site or continue work, as appropriate. The Site Supervisor will provide guidance regarding decontamination and/or disposition of equipment and vehicles.

If personnel come in contact with site contaminants, they should remove and dispose of contaminated PPE, change out of contaminated field clothing, and wash exposed skin with soap and water.

8.13 Cleanup Materials and Used Personal Protective Equipment Disposal

- Materials used in spill cleanup must be collected and placed in barrels and stored at the Site. Contaminated soil, soil cleaned from equipment, and decontamination water will also be drummed or placed in a rolloff container and stored. The Site Supervisor should assess whether the surficial material on which the spill is located requires treatment or removal and relay this information to the Project Manager.
- Decontamination of large equipment may be performed at a temporary decontamination pad set up at the Site or at a central decontamination pad.
- Tools used during spill cleanup will be thoroughly cleaned at the decontamination pad.
- Used PPE will be rinsed of gross contamination, placed in barrels, and stored at the job site.

8.14 Spill Prevention

To minimize the potential for a spill, follow these guidelines:

- Receive instruction concerning recognition of potential spill problems, preventative maintenance actions, and increased safety awareness.
- Inspect stored materials at the beginning of each workshift. The container condition, as well as any notation of leaks or staining that may be related to or indicative of a potential spill, will be

recorded in a field logbook. Deficiencies or corrective actions must be reported immediately to the Site Supervisor.

- Inspect transfer vehicles and equipment at the beginning of each day. Equipment conditions, as well as any notation of leaks or staining that may be related to or indicative of a potential spill, will be recorded in a field logbook. Loose and or worn connections and worn hoses will also be noted. Any abnormalities must be reported immediately to the Site Supervisor and steps should be taken to remedy the situation before continuing transfer activities.
- Make sure materials being stored are compatible with the containers in which they are being stored. Incompatible materials shall not be stored together.
- Store containers larger than 1 gallon separately from smaller quantities. Larger liquid storage containers will be stored in a warehouse and must have a secondary containment system. This system can be as simple as a liner with a berm constructed of 4-inch by 4-inch boarding and should be able to contain an amount 10 percent greater than that of the original container.
- Transfer liquid with catch basins under each joint or valve or with the hose or pipe lined so that no liquid can escape.

8.15 Responsibilities of Site Personnel

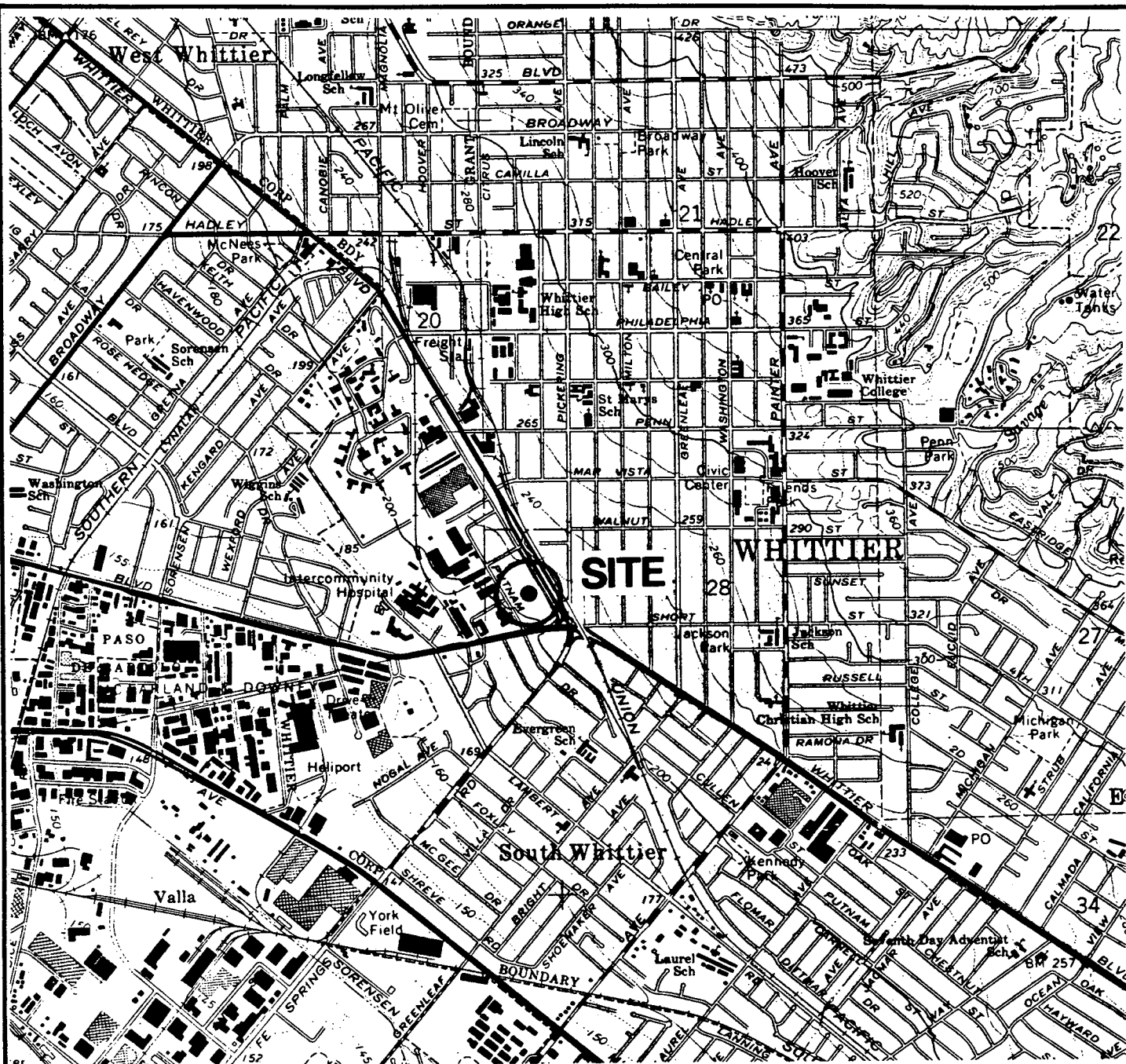
- Follow the first response directives in Section 8.2.
- Wear the correct and appropriate PPE for project completion.
- Use monitoring equipment applicable to the anticipated hazards (e.g., CGI, FID, PID)
- Have a decontamination area set up for fieldwork.
- Use approved decontamination procedures.
- Have available a means to decontaminate affected personnel.
- Treat minor injuries using the onsite first-aid kit.
- Take personnel with serious injuries to the nearest hospital to the Site or contact a medical emergency response team (Refer to Section 3.0, Health and Safety Plan).
- All personnel at the location where the incident has occurred must completely decontaminate and be debriefed by the SSHO before leaving the Site.
- Perform remedial actions as appropriate.

8.16 Emergency Response Equipment

The following is a list of minimum equipment that is required to be available for emergency response actions:

- 5-pound ABC-rated fire extinguisher
- First-aid kit
- Emergency shower
- Eyewash station or eyewash bottles (totaling 32 ounces)
- Appropriate type and quantity of absorbents for the situation
- Chemical-resistant brooms, shovels, and containment equipment

PLATES



Reference: USGS 7.5-minute quadrangle, Whittier, California (photorevised 1981)



HARDING LAWSON ASSOCIATES
Engineering and
Environmental Services

VICINITY MAP
Omega Chemical Corporation
Whittier, California

PLATE

1

DRAWN
JTL

PROJECT-TASK NUMBER
32026-12

APPROVED

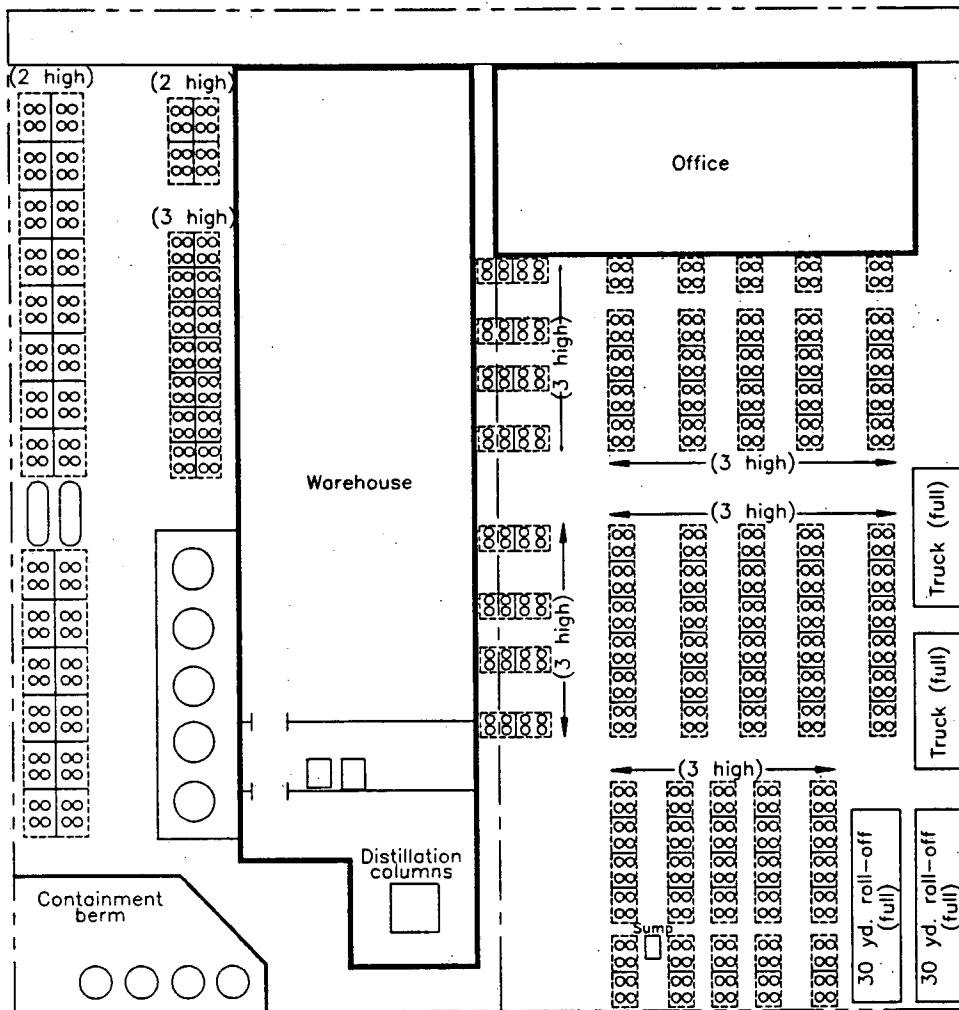
DATE
6/95

REVISED DATE

WHITTIER BOULEVARD

PACIFIC PLACE

WASHINGTON BOULEVARD



PUTNAM DRIVE

EXPLANATION

Location of storage pallets

APPROXIMATE
Scale 0 20 40 feet



HARDING LAWSON ASSOCIATES

Engineering and
Environmental Services

SITE PLAN

Omega Chemical Corporation
Whittier, California

PLATE

2

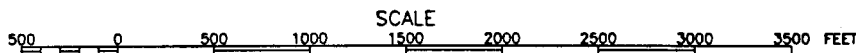
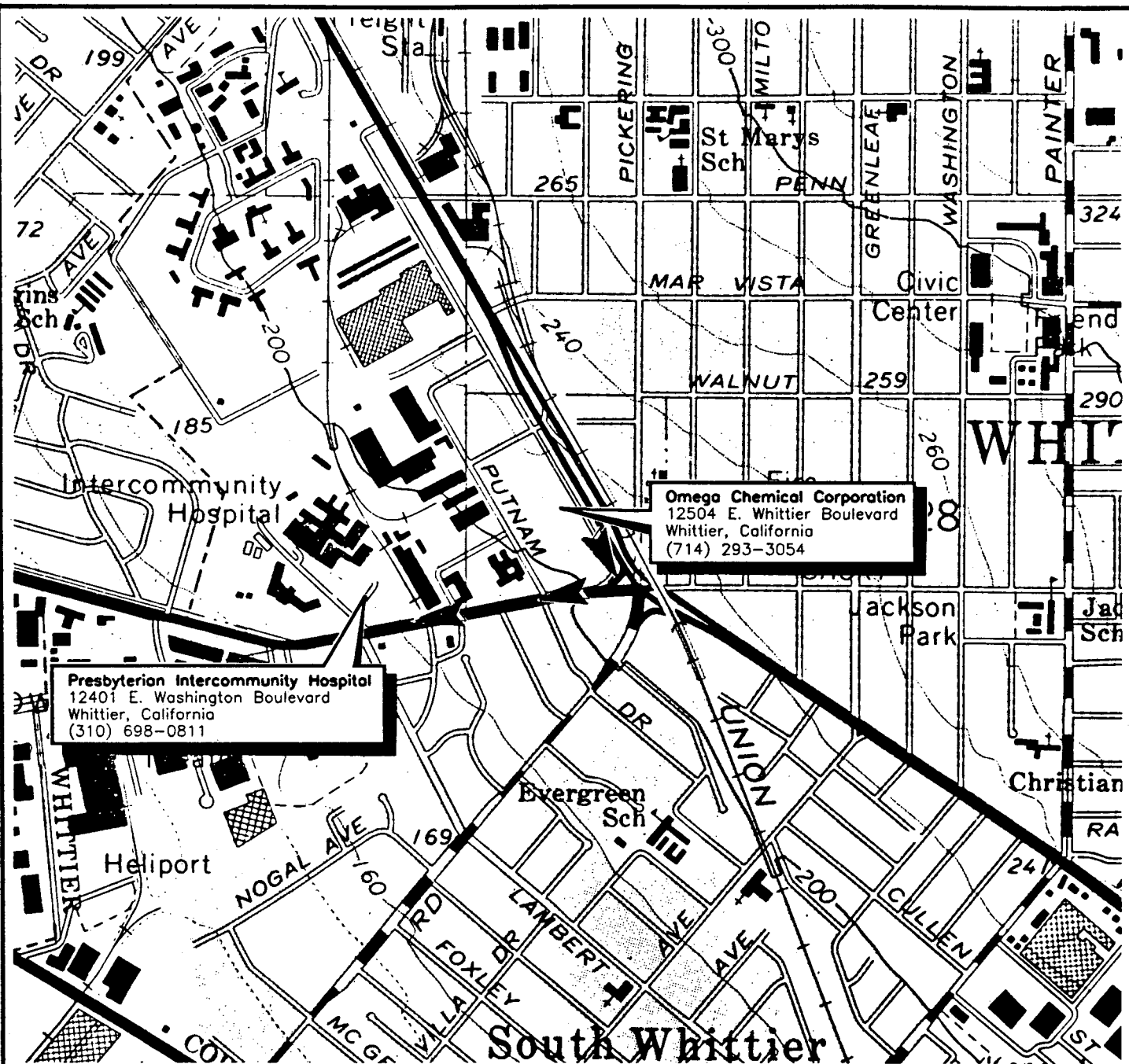
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32026-12

APPROVED
[Signature]

DATE
6/95

REVISED DATE



Reference: USGS 7.5-minute quadrangle, Whittier, California (photorevised 1981)



HARDING LAWSON ASSOCIATES
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Environmental Services

TRAVEL ROUTE TO HOSPITAL
Omega Chemical Corporation
Whittier, California

PLATE

3

DRAWN
JTL

PROJECT-TASK NUMBER
32026-12

APPROVED

DATE
6/95

REVISED DATE



HARDING LAWSON ASSOCIATES

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Environmental Services

DRAWN
JTL

PROJECT-TASK NUMBER
32026-12

APPROVED

DATE
6/95

REVISED DATE

TRANSPORTATION ROUTE MAP
Omega Chemical Corporation
Whittier, California

PLATE

4

APPENDIX A
PROJECT SCHEDULE

OMEGA CHEMICAL SITE

DRUM REMOVAL ACTION

Project Schedule

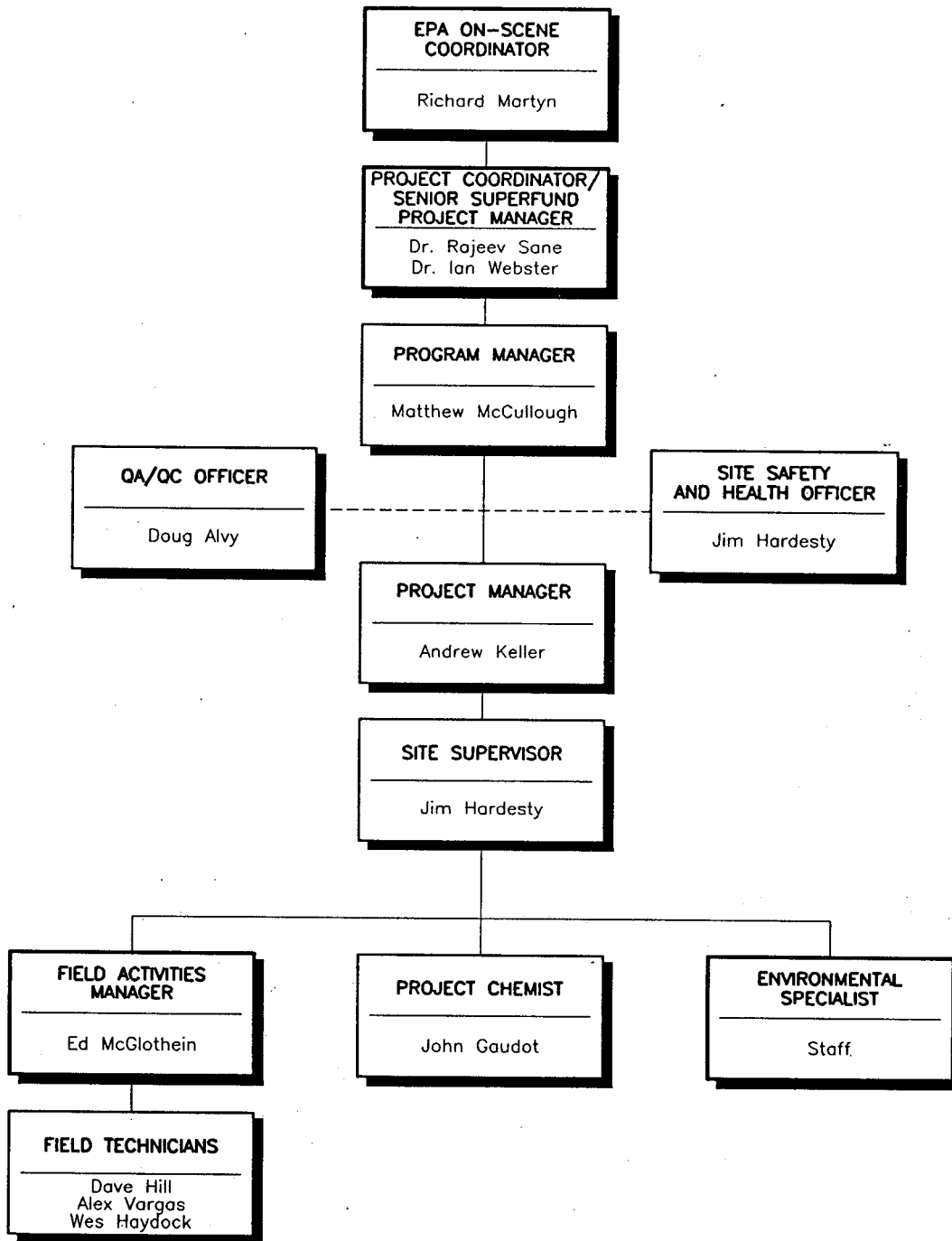
Task Name	Sched Start	Sched Fin	1995																	
			June					July					August					September		
			5/29	6/5	6/12	6/19	6/26	7/3	7/10	7/17	7/24	7/31	8/7	8/14	8/21	8/28	9/4	9/11	9/18	
Preparation of Phase I Work Plan	06/01/95	06/08/95																		
EPA Approval of Work Plan	06/08/95	06/14/95																		
Initiate Field Activities	06/14/95	06/17/95																		
Drum Removal	06/18/95	08/13/95																		
Equipment Decontamination	08/01/95	08/18/95																		
Phase I Report Preparation	08/18/95	09/18/95																		



Harding Lawson Associates
Engineering and
Environmental Services

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APPENDIX B
ORGANIZATIONAL RESPONSIBILITIES CHART



HARDING LAWSON ASSOCIATES
Engineering and
Environmental Services

**ORGANIZATIONAL RESPONSIBILITIES
WORKCHART**
Omega Chemical Corporation
Whittier, California

PLATE

DRAWN
JTL

PROJECT-TASK NUMBER
32026-13

APPROVED

DATE
6/95

REVISED DATE

APPENDIX C
DRUM HANDLING PROCEDURES

APPENDIX C
DRUM HANDLING PROCEDURES

1. Identify chemical and physical hazards present when handling containers.
 - a. Weight - A 55-gallon steel drum filled completely with water weighs approximately 450 lbs.
 - b. Equipment - Several hazards exist when using drum handling equipment. These hazards may include:
 - Falling drums
 - Personnel being struck by equipment
 - Personnel getting their hands caught between the container and the handling equipment resulting in a pinch point injury, and
 - Drum damage (dents, punctures, lids being stripped off resulting in a spill).
2. Procedures required before Movement begins.
 - a. Damaged drums that cannot be handled safely will be overpacked.
 - b. It is important to select a transport route that impacts the least amount of people possible.
 - c. Review the need to identify spill control equipment along the transport route or the need to have a spill control station with the material as it is being transported. An appropriate spill control station may be as little as an overpack drum with absorbent material inside.
3. Container Handling Preparation
 - a. Containers may be moved using drum slings, barrel grabbers, and a forklift, hand dolly, or on pallets.
 - b. Drum slings and barrel grabbers are not to be used to move drums over long distances. These devices will be used to place drums on pallets or trucks and for overpacking drums.
 - c. Inspection of material handling equipment is essential. Damaged equipment will not be used.
 - d. Personnel handling drums must stay at least an arms length away from drums in order to avoid physical injury.
 - e. Containers must be carefully placed to minimize damage during transport
 - Drums will be placed so ring bolts, valves, etc., are faced away from other drums to prevent punctures or damage.
 - Palletized drums shall be bound together to prevent movement which could cause damage.

APPENDIX D
SAFETY CHECKLIST

DRIVER'S INSPECTION REPORT

(SEE INSTRUCTIONS ON REVERSE SIDE)

MAINTENANCE CHECK DEFECTS ONLY. Explain under REMARKS **C 338501**
COMPLETION OF THIS REPORT REQUIRED BY FEDERAL LAW, 49CFR 396.11 & 396.13.

Mileage (No Tenths)

Truck or Tractor No. _____ Trailer No. _____

Dolly No. _____ Trailer No. _____ Location: _____

ATA/VMRS System Code Numbers for Shop Use Only

© 1980 American Trucking Associations, Inc.

POWER UNIT

GENERAL CONDITION

- ☐ 02 Cab/Doors/Windows
- ☐ 02 Body/Doors
- ☐ _____ Oil Leak _____
- ☐ _____ Grease Leak _____
- ☐ 42 Coolant Leak
- ☐ 44 Fuel Leak
- ☐ _____ Other _____

(IDENTIFY)

ENGINE COMPARTMENT

- ☐ 45 Oil Level
- ☐ 42 Coolant Level
- ☐ _____ Belts _____
- ☐ _____ Other _____

(IDENTIFY)

IN-CAB

- ☐ 03 Gauges/Warning Indicators
- ☐ 02 Windshield Wipers/Washers
- ☐ 54 Horn(s)
- ☐ 01 Heater/Detector
- ☐ 02 Mirrors
- ☐ 15 Steering
- ☐ 23 Clutch
- ☐ 13 Service Brakes
- ☐ 13 Parking Brake
- ☐ 13 Emergency Brakes
- ☐ 53 Triangles
- ☐ 53 Fire Extinguisher
- ☐ 53 Other Safety Equipment
- ☐ 34 Spare Fuses
- ☐ 02 Seat Belts
- ☐ _____ Other _____

(IDENTIFY)

EXTERIOR

- ☐ 34 Lights
- ☐ 34 Reflectors
- ☐ 16 Suspension
- ☐ 17 Tires
- ☐ 18 Wheels/Rims/Lugs
- ☐ 32 Battery
- ☐ 43 Exhaust
- ☐ 13 Brakes
- ☐ 13 Air Lines
- ☐ 34 Light Line
- ☐ 49 Fifth-Wheel
- ☐ 49 Other Coupling
- ☐ 71 Tie-Downs
- ☐ 14 Rear-End Protection
- ☐ _____ Other _____

(IDENTIFY)

☐ NO DEFECTS

TOWED UNIT(S)

- ☐ 71 Body/Doors
- ☐ 16 Suspension
- ☐ 77 Landing Gear
- ☐ 79 Rear-End Protection
- ☐ 71 Tie-Downs
- ☐ 17 Tires
- ☐ 59 Kingpin/Upper Plate
- ☐ _____ Other _____
- ☐ 34 Lights
- ☐ 18 Wheels/Rims/Lugs
- ☐ 59 Fifth-Wheel (Dolly)
- ☐ _____ Other _____
- ☐ 34 Reflectors
- ☐ 13 Brakes
- ☐ 59 Other Coupling Devices

(IDENTIFY)

☐ NO DEFECTS

REMARKS: _____

REPORTING DRIVER: Date _____
Name _____ Emp. No. _____

REVIEWING DRIVER: Date _____
Name _____ Emp. No. _____

MAINTENANCE ACTION: Date _____
Repairs Made ☐ No Repairs Needed ☐

R.O.#'s _____
Certified By: _____
Location: _____

SHOP REMARKS: _____

Reorder From: American Trucking Associations, 2200 Mill Road, Alexandria, VA 22314 1 800 ATA LINE

ATA FORM C0830 (REV. 1-80)

APPENDIX E
INSTRUMENT CALIBRATION PROCEDURES

APPENDIX E

INSTRUMENT CALIBRATION PROCEDURES

This appendix presents Harding Lawson Associates' (HLA's) standard operating procedures for field calibration and maintenance of direct reading instruments, personal sampling pumps, and detector tubes that may be used during field activities. Each equipment item is described and the calibration, operation, and maintenance procedures are detailed to the extent necessary to ensure proper care and use. Detailed procedures are provided in instrument-specific manuals from each manufacturer.

These standard operating procedures are intended to ensure that equipment is properly maintained and operated. These procedures were developed on the basis of the following assumptions:

- Procedures are consistent with the manufacturer's calibration, operation, and maintenance guidelines.
- Equipment calibration, operation, and maintenance procedures will be performed by properly trained HLA personnel.
- Only designated personnel will calibrate, operate, and maintain certain instruments.
- Records will be maintained to allow tracking of the calibration, operation, and maintenance of a given instrument.

PHOTOIONIZATION DETECTOR (HNU PI 101/HNU DL101/PHOTOVAC MICROTIP)

Theory of Operation

The portable photoionization detector (PID) detects the concentration of organic gases as well as a few inorganic gases. The basis for detection is the ionization of gaseous species. Every molecule has a characteristic ionization potential (IP) that is the energy required to remove an electron from the molecule, yielding a positively charged ion and the free electron. The incoming gas molecules are subjected to ultraviolet (UV) radiation, which is energetic enough to ionize many gaseous compounds. Each molecule is transformed into charged ion pairs, creating a current between two electrodes.

Three lamps, each containing a different UV light source, are available for use with most PIDs. Ionizing energies of the lamp are 9.5, 10.2, and 11.7 electron volts (eV). All three detect many aromatic and large molecule hydrocarbons. The 10.2 eV and 11.7 eV probes, in addition, detect some smaller organic molecules and some halogenated hydrocarbons. The 10.2 eV lamp is the most useful for environmental response work because it is more durable than the 11.7 eV lamp and detects more compounds than the 9.5 eV lamp. The following sections detail the proper calibration and field maintenance methods to be used with these PIDs.

HNU PI 101

The HNU PI 101 PID is designed for trace gas analysis in ambient air. The HNU PI 101 is factory-calibrated with certified standards of benzene, vinyl chloride, and isobutylene, with the reference standard being benzene. Because of the inherent toxicological risks associated with benzene and vinyl chloride, the primary calibration standard to be used should be isobutylene. When calibrating the unit with 100 parts per million (ppm) isobutylene, the SPAN control should be set at 9.8 and the unit should read approximately 70 ppm. This method of calibration converts the response of the unit to isobutylene to yield a direct reading of benzene that is based on the response factor of the unit using a 10.2 eV probe at a span setting of approximately 9.8. More simply stated, the required reading for calibration will be as follows:

$$\begin{aligned} &= \text{Isobutylene ppm} \times \frac{\text{photoionization sensitivity (isobutylene)}}{\text{photoionization sensitivity (benzene)}} \\ &= 100 \times 7/10 \\ &= 70 \text{ ppm} \end{aligned}$$

When using probes with 9.5 eV or 11.7 eV lamps, consult the user's manual for photoionization sensitivities and required SPAN control settings because these units may change for each individual lamp.

In cases where hazardous chemicals have been identified, the HNU PI 101 can also be calibrated to provide direct reading results of these chemicals. Please consult the user's manual and the Designated Safety and Health Officer (DSHO) to select chemicals for concern of appropriate calibration. The steps calibration method for the HNU PI 101 with a 10.2 eV lamp follows:

1. Identify the probe by the lamp label. If a question exists, disassemble the probe and inspect the lamp. The energy of the lamp should be etched into the glass envelope.
2. Connect the probe to the readout assembly, making sure the red interlock switch is depressed by the ring on the connector
3. Set the SPAN control potential to 9.8.
4. Battery check - turn the function switch to BATT. The needle should be in the green region. If it is not, recharge the battery.
5. Zero set - turn the function switch to STANDBY. In this position, the lamp is off and no signal is being generated. Allow the unit to sit for a minute to warm the parts. Set the ZERO point with the ZERO set control.
6. Fill a dedicated tedlar bag with the 100 ppm isobutylene in air SPAN gas.
7. Turn the function switch to the 0 to 200 range position. Attach the sampling bag to the probe inlet. Adjust the SPAN control setting to read approximately 70 ppm at a span setting of 9.8.

8. Record the units achieved at the set SPAN control and the calibration phase used.
9. Lamp cleaning - if calibration cannot be achieved at the desired span potential, the lamp must be cleaned. (See specific instrument manual for instructions)

HNU DL-101-2

The HNU DL-101-2 applies microprocessor capabilities to the basic photoionization detection principles exhibited by the HNU PI 101. The microprocessor provides electronic zeroing, site and time data logging, and the ability to store up to 12 calibrations. The unit provides two basic modes of operation, the first being the survey mode and the second being the hazardous waste mode. Like the PI 101, the DL-101-2 is also factory-calibrated using benzene as the reference standard. The primary method of calibration will also use 100 ppm isobutylene in air (the calibration gas standard) with the unit in the survey mode. If several compounds are suspected, the hazardous waste mode may be utilized to store the needed amount of calibration curves. In either case, it is essential to identify the lamp voltage being used and the photoionization sensitivities of the chemical species of interest.

To calibrate in the survey mode, follow these instructions:

1. Identify the lamp energy. If this information is not available on the outside of the probe, disassemble the probe and inspect the lamp. The energy of the lamp should be etched into the glass envelope.
2. Press the power button to start the unit. Wait one minute to allow the unit to warm up.
3. Fill a dedicated tedlar bag completely with isobutylene calibration standard.
4. Press the CALIBRATE key on the front panel. "Calibrate" should appear on the liquid crystal display (LCD).
5. Press ENTER. "Zeroing Unit" will appear on the LCD. The unit will display the unit concentration before the electronic zero. The display will then prompt: CE/ENT/EXIT Conc = ____ ppm. Enter the concentration of the calibration gas and press enter. "Attach gas to probe and /ENTER/" should appear on the LCD.
6. Attach the tedlar bag to the probe and press ENTER. Allow the sample to be naturally drawn into the unit. Press ENTER when ready. "xxxx ppm" should appear on the LCD. When the readings reach 100 ppm (± 10 percent), press ENTER. The LCD should then display "Calibrating...please wait."

In the survey mode, the unit will save the calibration and then the LCD reverts to the operation screen. When additional calibrations are called for, utilize the hazardous waste mode and cross reference calibration responses with the DL-101-2 user's manual.

Photovac MicroTIP

The MicroTIP must be calibrated to display concentrations in units equivalent to ppm. First, a supply of zero gas (total hydrocarbon concentration <1 ppm) is used to set the zero point. Then Span Gas (100 ppm isobutylene in air) is used to set the sensitivity.

Following these steps for MicroTIP calibration:

1. Turn the MicroTIP on and allow five minutes for warm up.
2. Fill the dedicated zero gas tedlar bag with zero gas calibration standard.
3. Fill the dedicated span gas tedlar bag with 100 ppm isobutylene in air calibration standard.
4. Press SETUP and select the desired Cal Memory (i.e., 100 ppm) with the arrow keys and press ENTER. Press EXIT to leave setup.
5. Press CAL and attach the filled zero gas bag to the MicroTIP probe. Press ENTER and the MicroTIP sets its zero point.
6. MicroTIP then asks for the span gas concentration. Enter 100.0 and then connect the span gas bag to the MicroTIP probe.
7. Press ENTER and MicroTIP sets its sensitivity.
8. When the display reverts to normal, the unit is calibrated and ready for use. Remove the span gas bag from the inlet.
9. Record applicable calibration information.

ORGANIC VAPOR ANALYZER FOXBORO MODEL 128 (OVA/FID)

Theory of Operation

The Foxboro Model 128 organic vapor analyzer (OVA) is designed to detect and measure hazardous vapors and gases. The instrument utilizes the principle of hydrogen flame ionization for detection and measurement of organic vapors. The instrument measures organic vapor concentration by producing a response to an unknown sample, which can be related to a gas of known composition to which the instrument has been previously calibrated. During normal survey mode operation, a continuous sample is drawn into the probe and transported to the detector chamber by an internal pumping system.

The sample stream is metered and passed through particulate filters before reaching the detector chamber. Inside the detector chamber, the sample is exposed to a hydrogen flame that ionizes the organic vapors. When most organic vapors burn, they leave positively charged carbon-containing ions. An electric field drives the ions to a collecting electrode. As the positive ions are collected, a current

corresponding to the collection rate is generated. This current is measured with a linear electrometer preamplifier that has an output signal proportional to the ionization current. A signal conditioning amplifier is used to amplify the signal from the preamp and to condition for display on the probe/readout assembly.

The OVA will primarily be used in the survey mode. In the survey mode, the OVA is internally calibrated to methane by the manufacturer. When the instrument is adjusted to manufacturer's instructions, it indicates the true concentration of methane in air. In response to all other detectable compounds, however, the instrument reading may be higher or lower than the true concentration.

The following procedures detail the operation, calibration, hydrogen refilling, and recharging methods to be used with the OVA:

1. Startup Procedures

- a. Connect the probe/readout assembly to the sidepack assembly by attaching the sample line and electronic jack to the sidepack.
- b. Select the desired sample probe (close area sample or telescoping probe) and connect the probe handle. Before tightening the knurled nut, check that the probe accessory is firmly seated against the flat seals in the probe handle and in the tip of the telescoping probe.
- c. Move the INST/BATT switch to the test position. The meter needle should move to a point beyond the white line, indicating that the integral battery has more than four hours of operating life before recharging is necessary.
- d. Move the INST/BATT switch to the "ON" position and allow a five-minute warm up.
- e. Turn the PUMP switch on.
- f. Use the Calibrate Adjust knob to set the meter needle to the level desired for activating the audible alarm. If this alarm level is other than zero, the CALIBRATE switch must be set to a appropriate range.
- g. Turn the Volume knob fully clockwise (optional).
- h. Using the Alarm Level Adjust knob, turn the knob until the audible alarm is activated (optional).
- i. Move the Calibrate Switch to x1 and adjust the meter reading to zero using the Calibrate Adjust (zero knob).
- j. Open the hydrogen Tank Valve one or two turns and observe the reading on the Hydrogen Tank Pressure Indicator. (Approximately 150 pounds per square inch [psi] of pressure is required for each hour of operation.)
- k. Open the Hydrogen Supply Valve one or two turns and observe the reading on the Hydrogen Supply Pressure Indicator. The reading should be between 8 and 12 psi.

- l. After approximately one minute, depress the IGNITER BUTTON until the hydrogen flame lights. The meter needle will travel upscale and begin to read "Total Organic Vapors." Caution: Do not depress igniter for more than six seconds. If flame does not ignite, wait one minute and try again.
- m. The instrument is ready for use. NOTE: If the ambient background organic vapors are "zeroed out" using the Calibrate Adjust knob, the meter needle may move off-scale in the negative direction when the OVA is moved in a location with lower background. If the OVA is to be used in the 0 to 10 ppm range, it should "zeroed" in an area with very low background. A charcoal filter (Part No. 510095-1) can be used to generate the clean background sample.

2. Calibration Using Known Samples for Each Range

The accuracy is obtained when the instrument is calibrated with known concentrations for each range. Prepare separate samples of methane-in-air in these concentration ranges: 7 to 10 ppm, 90 to 100 ppm, and 900 to 1000 ppm. Calibrate the instrument as follows:

- a. Place the instrument in normal operation and allow a minimum of 15 minutes for warm-up and stabilization.
- b. Set the Gas Select control to 300.
- c. Set the Calibrate switch to x1.
- d. Set the Calibrate Adjust (Zero) knob so that the meter reads zero.
- e. Check that the meter reads zero on the x10 and x100 ranges.
- f. Set the Calibrate switch to x1 and introduce the sample with known concentration in the 7 to 10 ppm range.
- g. Adjust R31 so the meter reading corresponds to the sample concentration.
- h. Set the Calibrate switch to x10 and introduce the sample with known concentration in the 90 to 100 ppm range.
- i. Adjust R32 so that the meter reading corresponds to the sample concentration.
- j. Set the Calibrate switch to x100 and introduce the sample with known concentration in the 900 to 1000 ppm range.
- k. Adjust R33 so that the meter reading corresponds to the sample concentration.
- l. The instrument is now calibrated for methane and ready for service.

If the flame-out alarm is actuated, check that the pump is running, then press the IGNITER button. Under normal conditions, flame-out results from sampling a gas mixture that is above the lower explosive level, which causes the hydrogen flame to extinguish. If this is the case, reignition is all that is required to resume monitoring. Another possible cause for flame-out is restriction of the sample flow line, which would not allow sufficient air into the chamber to support combustion. The normal cause for such restriction is a clogged particle filter.

It should be noted that the chamber exhaust port is on the bottom of the case and blocking this port with the hand will cause fluctuations and/or flame-out.

3. Shut Down Procedure

- a. Close HYDROGEN TANK valve
- b. Close HYDROGEN SUPPLY valve
- c. Move INSTRUMENT switch to OFF
- d. Wait five seconds and move PUMP switch to OFF. The instrument is now in a shut down configuration.

4. Fuel Refilling

Note: Use Prepurified or Zero grade hydrogen (certified total hydrocarbons as methane <0.5 ppm is recommended).

- a. The instrument and the charger should be completely shut down during hydrogen tank refilling operations. Refilling should be performed in a ventilated area. There should be no potential igniters or flame in the area.
- b. If you are making the first filling on the instrument or if the filling hose has been allowed to fill with air, the filling hose should be purged with hydrogen before filling the instrument tank. This purging is not required for subsequent fillings.
- c. The filling hose assembly should be left attached to the hydrogen supply tank when possible. Ensure that the FILL/BLEED valve on the instrument end of the hose is in the OFF position. Connect the hose to the refill connection on the Side Pack Assembly.
- d. Open the hydrogen supply bottle valve on the instrument panel and place the FILL/BLEED valve on the filling hose assembly in the FILL position. The pressure in the instrument tank will be indicated on the Hydrogen Tank Pressure indicator.
- e. After the instrument fuel tank is filled, close the REFILL valve on the panel, the FILL/BLEED valve on the filling hose assembly and the hydrogen supply bottle valve.
- f. The hydrogen trapped in the hose should not be bled off to atmospheric pressure. Caution should be used in this operation as described in Step (g) below because the hose will contain a significant amount of hydrogen at high pressure.
- g. The hose is bled by turning the FILL/BLEED valve on the filling hose assembly to the Bleed position. After the hose is bled down to atmospheric pressure, the FILL/BLEED valve should be turned to the FILL position to allow the hydrogen trapped in the connection fittings to go into the hose assembly. Then, again, turn the FILL/BLEED valve to the Bleed position and exhaust the trapped hydrogen. Then turn the FILL/BLEED valve to OFF to keep the hydrogen at one atmosphere in the hose so that at the time of the next filling there will be no air trapped in the filling line.
- h. Close the HYDROGEN TANK valve.
- i. With the HYDROGEN TANK valve and the HYDROGEN SUPPLY valve closed, a small amount of Hydrogen at high pressure will be present in the regulators and plumbing. As a leak check, observe the Hydrogen Tank Pressure indicator while the remainder of the system is shut down and ensure that the pressure reading does not decrease rapidly (more than 350 psi/hour), which would indicate a significant leak in the supply system.

5. Battery Charging

Warning: Never charge in a hazardous environment.

- a. Plug charger connector into mating connector on battery cover and insert alternating current (AC) plug into 115V AC wall outlet.
- b. Move the battery charger switch to the ON position. The lamp above the switch button should illuminate.
- c. Battery charge condition is indicated by the meter on the front panel of the charger; meter will deflect to the left when charging. When fully charged, the pointer will be in line with the "charged" marker above the scale.
- d. Approximately one hour of charging time is required for each hour of operation. However, an overnight charge is recommended. The charger can be left on indefinitely without damaging the batteries. When finished, move the battery charger switch to OFF and disconnect from the Side Pack Assembly.

It has been established that these battery charging procedures may not be effective when the battery has completely discharged. When this happens and the above procedures fail to charge the battery, perform the following additional steps:

- e. Remove the battery from the instrument case.
- f. Connect to any variable direct current (DC) power supply.
- g. Apply 40 volts at 1/2 ampere (A) maximum.
- h. Observe the power supply meter. As soon as the battery begins to draw current, gradually reduce the power maintaining 1/2 A maximum until the meter reads approximately 15 volts.

Note: The time required to reach the 15-volt reading will depend on degree of discharge.

- i. Repeat steps (a), (b), (c), and (d) above to complete the charging cycle.

SAMPLING PUMPS (SKC, MSA, or Gillian)

Sampling pumps utilized to collect personal and area samples will be calibrated before and after sampling. In each case, the sampling pumps will be calibrated in accordance with parameters established in National Institute of Occupational Safety and Health (NIOSH) Manual of Analytical Methods (1984). Calibration will be performed onsite using a primary standard (i.e., electronic bubble meter or 1-liter glass buret). Calibrations of sampling trains will be conducted with the collection media (i.e., charcoal tubes, XAD-2 tubes, tenax, cyclone separators, impingers, etc.) in line with the primary standard to ensure quality data.

The following calibration procedures should be followed when calibrating sampling trains:

1. Electronic Bubble Meter Method

- a. Allow the pump to run five minutes before voltage check and calibration.
- b. Connect the collection media to the bottom of the calibration meter by Tygon tubing. Then connect the pump and the tubing to be used to the top of the meter. This will allow the sampling train to be calibrated as it is to be used.
- c. Visually inspect all Tygon tubing connections.
- d. Wet the inside of the electronic flow cell with the supplied soap solution by pushing on the button several times.
- e. Turn on the pump and adjust the pump rotameter, if available, to the appropriate flow rate setting.
- f. Press the button on the electronic bubble meter. Visually capture a single bubble and electronically time the bubble. The accompanying printer will automatically record the calibration reading in liters per minute.
- g. Repeat step f until two readings are within 5 percent.
- h. While the pump is still running, adjust the pump, if necessary.
- i. Repeat the procedure for all pumps to be used for sampling. The same cassette and filter may be used for all calibrations involving the same sampling method.

Bubble-meter Method

Perform calibration using the bubble-meter method as follows:

1. Allow sampling pumps to run for five minutes before calibration. Check voltage after five minutes. If the voltage is below the level specified by the manufacturer, the pump needs to be recharged. Check the manufacturer's instructions for proper charging procedures.
2. Wet the inside of the burette with the soap solution before setup.
3. Assemble the bubble meter and connect the sampling pump and the type of collection device intended for the field sampling.
4. Momentarily submerge the opening of the burette to capture a film of soap.
5. Draw two or three bubbles up the burette to ensure that they will reach the top.
6. Visually capture a single bubble and time (with a stopwatch) the bubble from 0 to 1000 milliliter (ml) or 0 to 100 ml, depending on the pump being calibrated.
7. Adjust the pump flow rate until the desired flow rate is achieved. For example, for a flow rate of 2 liters per minute, the bubble must travel from 0 to 1000 ml in 30 seconds. Verify the flow rate at least twice.

8. For pumps with rotameters, mark or record the position of the float (ball) when the pump is running at the desired flow rate. This will allow the industrial hygienists to adjust the pump flow rate back to the correct rotameter position if the float moves off the marked setting during sampling.

DETECTOR TUBES/PUMPS (Sensidyne/Gastech, Draeger, MSA)

Principle/Description

1. Detector tubes/pumps, when used with a variety of commercially available detector tubes, are capable of measuring the concentrations of a wide variety of compounds in industrial atmospheres.
2. Operation consists of using the pump to draw a known volume of air through a detector tube designed to measure the concentration of the substance of interest. The concentration is determined by a calorimetric change of an indicator that is present in the tube contents.

Applications/Limitations

1. Detector tubes/pumps can measure more than 200 organic and inorganic gases and vapors or for leak detection. Some aerosols can also be measured.
2. Detector tubes of a given brand are to be used only with a pump of the same brand. The tubes are calibrated specifically for the same brand of pump and may give erroneous results if used with a pump of another brand.
3. A limitation of many detector tubes is the lack of specificity. Many indicators are not highly selective and can cross-react with other compounds. Manufacturer's manuals describe the effects of interfering contaminants.
4. Another important consideration is sampling time. Detector tubes give only an instantaneous interpretation of environmental hazards. This may be beneficial in potentially dangerous situations or when ceiling exposure determinations are sufficient. When long-term assessment of occupational environments is necessary, short-term detector tube measurements may not reflect time-weighted average levels of the hazardous substances present.
5. Detector tubes normally have a shelf-life at 25 degrees Celsius (°C) of one to two years. Refrigeration during storage lengthens the shelf-life. Outdated detector tubes (i.e., beyond the printed expiration date) should never be used.

Performance Data

1. The specific tubes are designed to cover a concentration range that is near the Permissible Exposure Limit (PEL). Concentration ranges are tube-dependent and can be anywhere from one one-hundredth to several thousand ppm. The limits of detection depend on the particular detector tube.
2. Accuracy ranges vary with each detector tube (± 25 percent).

3. The pump may be handled during operation (weighing from 8 to 11 ounces) or it may be an automatic type (weighing about 4 pounds) that collects a sample using a preset number of pump strokes. A full pump stroke of either type of short-term pump has a volume of about 100 cubic centimeters (cm^3).
4. In most cases where only one pump stroke is required, sampling time is about one minute. Determinations for which more pump strokes are required take proportionately longer.

Leakage Test

1. Each day before use, perform a pump leakage test by inserting an unopened detector tube into the pump and attempt to draw in 100 ml of air. After a few minutes, check for pump leakage by examining pump compression for bellows-type pumps or return to resting position for piston-type pumps. Automatic pumps should be tested according to the manufacturer's instructions.
2. In the event of leakage that cannot be repaired in the field, notify the DSHO to expedite repairs.
3. Record leakage test on the HLA Air Monitoring Calibration Form.

Calibration Test

1. Calibrate the detector tube for proper volume measurement at least quarterly.
2. Simply connect the pump directly to the bubble meter with a detector tube in-line. Use a detector tube and pump from the same manufacturer.
3. Wet the inside of the 100 cm^3 bubble meter with soap solution.
4. For volume calibration, experiment to get the soap bubble even with the zero mark of the buret.
 - a. For piston-type pumps, pull the pump handle all the way out (full pump stroke) and note where the soap bubble stops; for bellows-type pumps, compress the bellows fully; for automatic pumps, program the pump to take a full pump stroke. For either type pump, the bubble should stop between the 95 cm^3 and 105 cm^3 marks. Allow four minutes for the pump to draw the full amount of air (This time interval varies with the type of detector tube being used in-line with the calibration setup).
 - b. Also check the volume of 50 cm^3 (1/2 pump stroke) and 25 cm^3 (1/4 pump stroke) if pertinent. As in Section 1 above, a ± 5 percent error is permissible. If error is greater than ± 5 percent, send the pump for repair and recalibration.
5. Record the calibration information required on the Calibration Log.
6. It may be necessary to clean or replace the rubber bung or tube holder if a large number of tubes have been taken with the pump.

Additional Information

1. Draeger, Model 31 (bellows)

When checking the pump for leaks with an unopened tube, the bellows should not be completely expanded after 10 minutes.

2. Draeger, Quantimeter 1000, Model 1 (automatic)

A battery pack is an integral part of this pump. The pack must be charged before initial use. One charge is good for 1000 pump strokes. During heavy use, it should be recharged daily. If a "U" (undervoltage) message is continuously displayed in the readout window of this pump, the battery pack should be immediately recharged.

3. Mine Safety Appliances, Sampler Pump, Model A, Part No. 463998 (piston)

The pump contains a flow rate control orifice protected by a plastic filter that periodically needs to be cleaned or replaced. To check the flow rate, the pump is connected to a buret and the piston is withdrawn to the 100-ml position with no tube in the tube holder. After 24 to 26 seconds, 80 ml of air should be admitted to the pump. Every six months, the piston should be relubricated with the oil provided.

4. Sensidyne-Gastec, Model 800, Part No. 7010657-1 (piston)

This pump can be checked for leaks as mentioned for the Kitagawa pump; however, the handle should be released after one minute. Periodic relubrication of the pump head, the piston gasket, and the piston check valve is needed and is use-dependent.

Special Considerations

1. Detector tubes should be refrigerated when not in use to prolong shelf life.
2. Detector tubes should not be used when cold. They should be kept at room temperature or in a shirt pocket for one hour before use.
3. Lubrication of the piston pump may be required if volume error is greater than 5 percent.

COMBUSTIBLE GAS INDICATOR (Model 361 or equivalent)

Theory of Operation

The Model 361 Hydrogen Sulfide combustible gas and oxygen sensors operate simultaneously. Each sensing circuit is equipped with an individual, visual alarm descriptor. There is a common, pulsating audible alarm. One position of the FUNCTION switch enables the audible alarm to be turned off, if so desired. The alarm descriptors will remain on until the concentration returns to within the alarm setpoints and the reset button is depressed.

A low-battery alarm will activate the BATT descriptor on the display and a continuous, steady-sounding audible alarm. This steady sound indicates that the Model 361 must be removed from service and charged in a nonhazardous area.

WARNING: Exposure of the combustible gas sensor to a concentration high enough to cause the readout to indicate a reading higher than 100 percent Lower Explosive Limit (LEL) will cause the readout to latch. When latched, the LEL readout will be blank and the descriptors for OVER and LEL ALARM will appear. This latching circuit is a warning that the gas concentration has exceeded the LEL and that all personnel must evacuate the area.

This latching circuit can be reset by removing the Model 361 to an area known to be free of combustible gas (fresh air) and turning off the instrument. The Model 361 can then be turned on and rezeroed in fresh air. This latch circuit does not operate during the first 30 seconds after turning on the instrument, thus providing sufficient time for sensor warm-up and rezeroing.

Toxic Gas Sensor

The toxic gas sensor used in the Model 361 is a membrane-sealed electrochemical cell. The cell requires an external voltage source to function and produces a current output that is proportional to the amount of H_2S present. The H_2S diffuses through the front membrane of the cell and is oxidized at the working electrode. Current flows through the liquid electrolyte (acid solution) to the counter/reference electrode where oxygen reduction occurs. The amount of current produced for a concentration of H_2S is dependent on the voltage across the working reference electrodes as well as the electrode materials and the electrolyte. The choice of the particular noble metal electrodes and the setting of the cell voltage optimizes the sensor for the detection of H_2S .

The current from the cell is fed to a current-to-voltage converter. This voltage signal is applied to an amplifier that drives the toxic gas readout and provides an input for an alarm comparator circuit.

Combustible Gas Sensor

The flammable properties of combustible gases are used as the basis of detection. The sensor consists of a pair of pelletized filaments called Pelements™ arranged in an electrically balanced bridge circuit. The detector pelement is treated with a catalyst that causes the combustible gases to combine with oxygen at much lower temperatures than would be required for normal burning. The inactive compensator pelement is also exposed to the sample flow and acts to offset any electrical changes caused by flow conditions, sample temperature, pressure, and/or humidity.

Combustible gases in the sample combine with oxygen in the air at the surface of the catalyzed detector pelement. Heat is liberated by this chemical reaction, thus increasing the temperature of the pelement and causing an associated increase in the pelement electrical resistance.

Increased resistance of the detector pelement unbalances the bridge circuit, causing a voltage change at the mid-point connection between the detector pelement and the compensating pelement. This voltage signal is applied to an amplifier that drives the combustible gas readout and provides an input for an alarm comparator circuit.

Oxygen Sensor

The oxygen sensor is a galvanic type cell containing gold and lead electrodes in a potassium hydroxide solution. The cell is sealed with a membrane that allows oxygen to diffuse into the active area. The current generated by the cell is proportional to the oxygen partial pressure in the atmospheric sample passing over the face of the membrane. The generated current passes through a resistance to provide a voltage input signal for an amplifier. The output of the amplifier drives the oxygen readout and also serves as an input to the alarm comparator circuit.

The following instructions detail the procedures for operation and calibration of the MSA Model 361 Combustible Gas Indicator.

Operating Instructions

The Model 361 oxygen calibration and toxic and combustible zero checks must be made in fresh air or with the inlet end of the sampling line in fresh air.

1. Turn the FUNCTION control to the HORN OFF position; the HORN OFF indicator will light and the descriptor percent LEL will show in the readout.
2. Set the readout to zero (00) by adjusting the LEL ZERO control (NOTE: this must be done within 30 seconds of turning ON to prevent the possibility of activating the off-scale LEL latching alarm).
3. Press the SELECT button firmly to obtain percent OXY on the readout; then set the readout to 20.8 percent by adjusting the OXY CALIBRATE control.
4. Press the SELECT button firmly to obtain PPM TOX on the readout; then set the readout to zero (00) by adjusting the TOX ZERO control.
5. Press the RESET button.
6. Turn the FUNCTION control to MANUAL for continuous readout of any one gas or to SCAN for automatic scanning of the three gas readings. (NOTE: All alarm functions operate in either position.)

7. Momentarily place a finger over the sample inlet fitting or the end of the sample line, if one is used. Observe that the FLOW indicator float drops, indicating no flow. If it does not, check the flow system and sample line for leaks.
8. The instrument is ready for calibration.

WARNING: If an alarm is indicated by an ALARM or OVER sign in the readout or a pulsing horn, evacuate personnel from the area and notify the safety officer.

A low battery condition is indicated by a BATT sign in the readout or by a steady horn; remove the Model 360 or 361 and recharge in a nonhazardous area to prevent potential ignition of combustible atmospheres.

Model 361 Calibration

1. Attach the flow control to the 0.75 percent pentane/15 percent oxygen calibration gas tank.
2. Connect the adapter-hose to the flow control.
3. Open the flow control valve.
4. Connect the adapter-hose fitting to the inlet of the instrument; within 30 seconds, the LEL meter should stabilize and indicate between 47 and 55 percent. If the indicator is not in the correct range, remove the right end of the indicator and adjust the LEL SPAN control to obtain 50 percent.
5. Verify the oxygen reading; it should be between 13 and 17 percent.
6. Disconnect the adapter-hose fitting from the instrument.
7. Close the flow control valve.
8. Remove the flow control from the calibration gas tank.
9. Attach the flow control to the 10 ppm hydrogen sulfide calibration gas tank (40 ppm gas may be used; the choice of H₂S calibration will depend on concentrations anticipated in the work place).
10. Open the flow control valve.
11. Connect the adapter-hose fitting to the inlet of the instrument; after approximately one minute, the TOX readout should stabilize and indicate between 7 to 13 ppm (35 to 45 ppm for 40 ppm H₂S). If the indication is not in the correct range, remove the right end of the indicator and adjust the TOX SPAN control to obtain 10 ppm (40 ppm for 40 ppm H₂S).
12. Disconnect the adapter-hose fitting from the instrument.
13. Close the flow control valve.
14. Remove the adapter-hose from the flow control.

15. Remove the flow control from the calibration gas tank.

CAUTION: Calibration gas tank contents are under pressure. Do not use oil, grease, or flammable solvents on the flow control or the calibration gas tank. Do not store calibration gas tank near heat or fire, nor in rooms used for habitation. Do not throw in fire, incinerate, or puncture. Keep out of the reach of children. It is illegal and hazardous to refill this tank. Do not attach any gas tank other than MSA calibration tanks to the flow control.

APPENDIX F
QUALITY ASSURANCE PROGRAM

QUALITY ASSURANCE PROGRAM

DEL MAR ANALYTICAL

JANUARY 1995

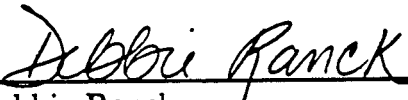
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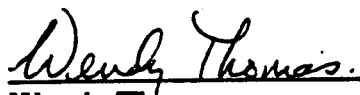

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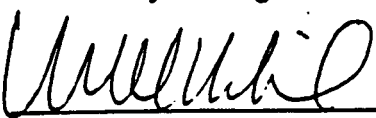
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3.0 INTRODUCTION

Del Mar Analytical is committed to providing quality environmental analytical services to all of its clients. To maintain this high level of quality, an extensive Quality Assurance (QA) Program has been implemented within the Del Mar Analytical Network. Del Mar Analytical's goal is to provide legally defensible analytical data of known and supportable quality.

3.1 DEFINITION

A Quality Assurance Program is a company-wide system designed to ensure that data produced by Del Mar Analytical conforms to the highest standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through standard operating procedures and quality control. These two levels are administered through data control and review processes. The final result is a data package that is reproducible, technically accurate, and useful to the client.

3.2 SCOPE

Del Mar Analytical analyzes thousands of environmental and industrial samples every month. Sample matrices vary between air, drinking water, effluent water, groundwater, hazardous waste, sludge and soils. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical, physical and biological parameters. The Program also contains guidelines on maintaining documentation of analytical process, reviewing results, servicing clients and tracking samples through the laboratory.

3.3 PURPOSE

The Quality Assurance Program provides a means by which the integrity of data can be verified. Since engineering, environmental and industrial decisions are based on the data produced, it is essential that clear and extensive verification procedures exist. Accuracy, appropriate representation, completeness and precision are all aspects of a data package that verify the integrity of the analysis.

The Quality Assurance Program is also a useful historical document. The chronological development of any Quality Assurance Program relies on the adequate documentation of previous programs. Improvements and modifications can be instituted only if an established frame of reference exists and the comparative benefits of such changes can be judged.

The Quality Assurance Program is the format through which Del Mar Analytical can express its goals, policies, and commitment to generating data of the highest quality. The Quality Assurance Program outlines how the laboratory will meet those goals through time, resources, and its employees.

3.4 GOALS

Del Mar Analytical is dedicated to the production of high quality data at reasonable cost and turn-around-time. State-of-the-art analytical equipment is combined with professional client services so that projects, both large and small in scope, are successfully completed. Emphasis is placed upon meeting the clients' needs through the experience and flexibility of dedicated professionals. The company's organization, management policies, and routine activities are all designed to meet these goals.

3.5 MANAGEMENT REVIEW OF THE QUALITY ASSURANCE PROGRAM

Annually, a review of the Quality Assurance Program is conducted by the management of Del Mar Analytical. Included in this review is the Laboratory Director, Laboratory Manager, Technical Manager, Quality Assurance Officer, Marketing Manager, and Office Manager. This review helps to ensure that the laboratory's quality system is capable of meeting Del Mar Analytical's goal of producing quality data. All aspects of the Quality Assurance Program are reviewed. In general, results of audits, both internal and external, are reviewed along with proficiency evaluation results and staff training. In addition, future plans regarding staff, equipment and facility resources are reviewed. The Quality Assurance Officer is responsible for ensuring that the review occurs, and that all review findings are documented. Documentation consists of meeting minutes, along with written documentation of any necessary corrective actions revealed during the review of the quality system. The Quality Assurance Officer is also responsible for implementing the corrective actions, and for documenting that implementation had occurred. All review findings and corrective action documentation are kept on file with the Quality Assurance Officer.

4.0 PROJECT ORGANIZATION

Del Mar Analytical is structured to facilitate communications between management and analytical levels, and to ensure that the final data package produced for the client meets or exceeds regulatory standards. An example of Del Mar Analytical's organization chart may be found in Figure 4-1. The following are brief descriptions of the major organizational levels.

4.1 PRESIDENT/LABORATORY DIRECTOR

The President/Laboratory Director works closely with the Vice-President/Laboratory Manager and is responsible for all major financial decisions, including the expansion of satellite laboratory facilities, staff selection, promotion, and major instrument acquisition. The President/Laboratory Director is also ultimately responsible for the entire laboratory operation, final technical review, approval of analytical reports, and all aspects of client services.

4.2 VICE PRESIDENT/LABORATORY MANAGER

The Vice President/Laboratory Manager is responsible for all internal laboratory operations, which include Manager and Group Leader supervision, staff promotion and discipline, cross-training, and method interpretation. The Vice President/Laboratory Manager is also responsible for administering the Quality Assurance Program and has direct authority over the Quality Assurance Officer.

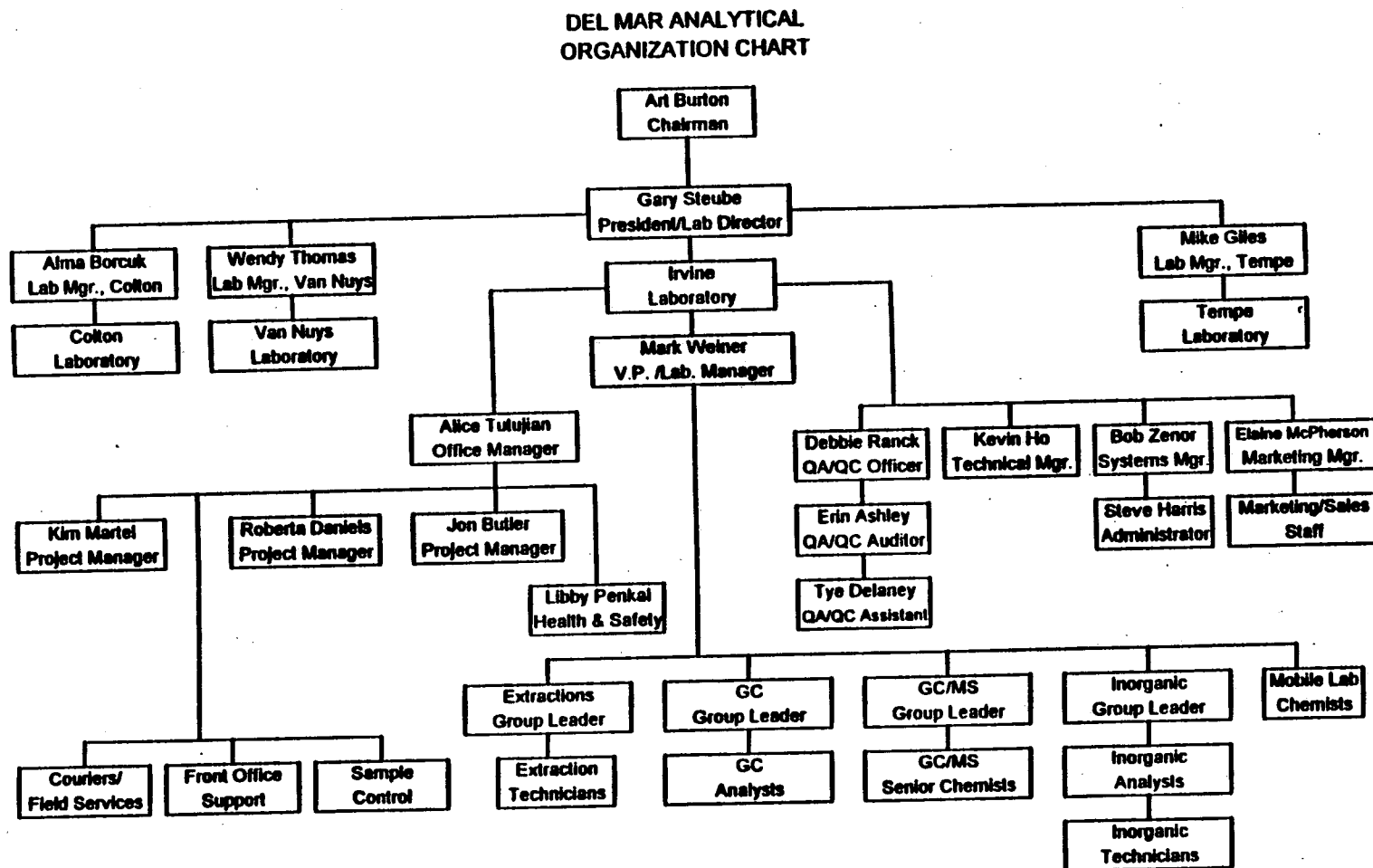
4.3 QUALITY ASSURANCE OFFICER

The Quality Assurance Officer is responsible for the implementation and review of the Quality Assurance Program, all quality control procedures, internal checks and audits, QC data reporting, and overseeing the Internal Quality Assurance Auditor. The QA/QC Officer has direct authority to request re-analysis of samples and to discontinue or suspend work on projects if deemed necessary. The QA/QC Officer answers directly to the Laboratory Director and the Laboratory Manager.

4.4 INTERNAL QUALITY ASSURANCE AUDITOR

The Internal Quality Assurance Auditor is responsible for reviewing the Analyst's files, notebooks, and raw data for documentation of all quality control measurements. In addition, it is the responsibility of the Internal Quality Assurance Auditor to control and maintain all documentation pertaining to the Quality Assurance Program, such as Standard Operating Procedures, Method Detection Limits Studies, and Performance Evaluation Studies. The Internal Quality Assurance Auditor maintains historical files of all quality system documents, as well as current, authorized

Figure 4-1
Del Mar Analytical Organization Chart



copies of quality system documents. Furthermore, the Internal Quality Assurance Auditor performs annual performance audits which are documented to assure that the requirements of the Quality Assurance Program are met.

Follow-up audits are scheduled as needed until corrective actions are fully implemented. Copies of all Performance Audits are given to the QA/QC Officer and the Laboratory Manager for review and input. The issuance and tracking of individual Analyst performance on blind check samples is also the Internal QA Auditor's responsibility. These results are provided to the appropriate Department Supervisor for review and inclusion with individual training records. The Internal QA Auditor reports directly to the QA/QC Officer.

4.5 QUALITY ASSURANCE/QUALITY CONTROL ASSISTANT

The Quality Assurance/Quality Control Assistant is responsible for the timely and accurate transcription of client/sample documentation, and QC Matrix Spike/Matrix Spike Duplicate data into final analytical reports. He or she works closely with the QA/QC Officer and the Project Managers to insure that proper QA/QC is followed during data transcription and report origination. The QA/QC Assistant generates and reviews, in conjunction with the QA/QC Officer, all QA/QC analytical reports and assists with the preparation of Control Charts.

4.6 HEALTH & SAFETY OFFICER

The Health and Safety Officer is responsible for administering the Health and Safety Program. This includes routine internal health and safety audits of the facility as well as management of the Hazardous Waste program. The Health and Safety Officer is also responsible for the execution of the Chemical Hygiene Program, which involves educating and training all personnel. He or she is responsible for monitoring and recording OSHA compliances and insuring the proper storage and disposal of laboratory hazardous and non-hazardous wastes.

4.7 SAMPLE CONTROL LEADER

The Sample Control Leader is responsible for receiving and entering samples into the LIMS log-in computer, recording sample condition and reviewing all Chain-of-Custody forms, as well as the review and coordination of the Sample Control staff's duties. He or she acts as a liaison between Project Managers and Analysts in respect to handling rush orders, resolving inconsistencies and problems with Chain-of-Custody forms, and routing of sub-contracted analyses.

4.8 MARKETING MANAGER

The Marketing Manager is responsible for developing new clients and proper company image, identifying and targeting potential markets, making presentations to clients, and updating and generating company literature. The Marketing Manager is directly responsible for the supervision and management of Del Mar Analytical's marketing staff.

4.9 SYSTEMS MANAGER

The Systems Manager is directly responsible for the design, implementation, and maintenance of Del Mar Analytical's GC Turbochrom program, LIM systems, QC computer programs, Telecation software for CLP data packages, and other related software. He or she also designs and writes programs for the company when commercial programs are not appropriate or applicable, and generates all electronic data deliverables as requested by clients.

4.10 TECHNICAL MANAGER

The Technical Manager is responsible for the development and implementation of new methods, maintenance and repair of all instruments and equipment, trouble-shooting, and the acquisition of new instruments. He or she is also responsible for training new personnel and cross-training current employees to operate in other departments. He or she works closely with the QA/QC Officer to insure proper calibration and operation of all analytical equipment. He or she also works directly with the Systems Manager to help implement new computer analytical programs, maintain current system, and develop ideas for future improvements.

4.11 PROJECT MANAGERS

Project Managers are responsible for thoroughly coordinating internal projects, maintaining clients' satisfaction and reviewing laboratory reports. All project status and technical questions generated by the client are directed to the Project Manager.

4.12 OFFICE MANAGER

The Office Manager oversees the Sample Control Group and is responsible for personnel supervision and promotion. The Office Manager directly supervises and manages the accounting, clerical and courier staff. He or she also conducts employee hiring, employee discipline, and performance reviews for the non-technical staff.

4.13 DATA PROCESSORS

The Data Processors are responsible for the timely and accurate transcription of client/sample documentation and analytical results into final analytical reports. They work closely with the Project Managers to insure that proper QA/QC is followed during data transcription and report generation. They prepare a variety of Deliverable Packages, such as: Los Angeles Region Water Quality Control Board Well Investigation Program (WIP) reports, NEESA Level III and IV reports, and custom report formats requested by clients.

4.14 SAMPLE CONTROL

The Sample Control Group is responsible for checking for sufficient sample volume, ensuring that bottles are properly prepared and preserved, receiving and entering samples into the log-in computer system, recording sample condition, and reviewing Chain-of-Custody forms. They act as a liaison between Project Managers and Analysts in respect to handling rush orders, resolving inconsistencies and problems with Chain-of-Custody forms, and routing of sub-contracted analyses.

4.15 COURIERS/SAMPLING TECHNICIANS/FIELD SERVICE TECHNICIANS

This group is responsible for general courier duties, water sampling by the grab method, and the proper installation of automatic ISCO 24 hour water sampling equipment.

4.16 ORGANICS SUPERVISOR

The Organics Supervisor is responsible for the supervision of operations within the GC Organics and GC/MS Organics Groups, secondary data review generated by group Analysts, maintenance of all group records and logs, and performance of Semi-Volatiles analyses by GCMS--8270/625 analyses.

4.17 INORGANICS SUPERVISOR

The Inorganics Supervisor is responsible for the supervision of operations within the Inorganics Group, which includes the Metals Group and Wet Chemistry Group, secondary data review generated by the group Analysts, maintenance of all group records and logs, and performance of AA and ICP Metals analyses.

4.18 EXTRACTIONS SUPERVISOR

The Extractions Supervisor is responsible for the daily functions of the Extractions Group, including evaluation of analyses and extractions, secondary data review, maintenance of all group record and activity logs, equipment operations, and employee performance.

4.19 ANALYSTS - GC, GC/MS, METALS, WET CHEMISTRY

The Analysts are responsible for all aspects of assigned analytical procedures, including overseeing sample preparation and preservation, performing the analyses, and reporting the results within the specified turn-around-times. They must adhere to all QC procedures specified in the analytical method and the full documentation of these procedures. In addition, they are responsible for routine maintenance of their equipment and ensuring sufficient supplies for analyses.

- Extractions
- Gas Chromatography
- GC/MS
- Metals
- Wet Chemistry

5.0 CERTIFICATION

Del Mar Analytical is certified by the State of California Department of Health Services under the Environmental Laboratory Accreditation Program (ELAP) for the analyses of drinking water, wastewater, and hazardous waste. Del Mar Analytical's ELAP certificate numbers are as follows:

- 1197 for the Irvine laboratory
- 1169 for the Colton laboratory
- 1855 for the Van Nuys laboratory
- 1794 for the Mobile laboratory

Del Mar Analytical is also certified by the State of Arizona Department of Health/Division of State Laboratory Services. Certificate numbers are as follows:

- AZO426 for the Tempe, AZ laboratory
- AZM426 for the Tempe, Mobile laboratory
- AZ0062 for the Colton, CA laboratory
- AZ0428 for the Irvine, CA laboratory

To keep informed of new technologies and regulations, many of our employees are active in professional organizations, which include the following:

- actLabs (Association of California Testing Laboratories)
- American Chemical Society
- American Council of Independent Laboratories
- American Water Works Associations
- Association of California Testing Laboratories
- Association of Hazardous Testing Materials
- California Water Pollution Control Association
- IAETL (International Association of Environmental Testing Laboratories)
- Water Pollution Control Federation

5.1 PERSONNEL SUMMARY

Total Staff.....83

Total Scientific Staff.....52

5.2 CERTIFICATES AND UNDERGRADUATE AND GRADUATE DEGREES HELD BY
DEL MAR ANALYTICAL EMPLOYEES

- Analytical Chemistry
- Biology
- Chemical Engineering
- Drug and Chemical Technology
- Engineering
- Environmental Science
- Geology
- Health Science
- Petroleum Chemistry
- Physics
- Sociology
- Zoology
- Biochemistry
- Business Administration
- Chemistry
- Ecology
- English
- Forensic Sciences
- Hazardous Materials Management
- Mathematics
- Pharmacy
- Psychology
- Supervisor Training

6.0 CONFIDENTIALITY STATEMENT

The protection of confidential client information, business information and trade secrets is vital to the interests and the success of this organization. Such confidential information includes, but is not limited to the following:

- Client contact representatives
- Client lists
- Del Mar Analytical's organizational structure
- Financial Information
- Marketing Strategies
- Pending projects and proposals
- Scientific Data
- Specific client/project information

As a condition of employment, all employees are required to sign a non-disclosure agreement similar to the one shown in Figure 6-1.

Client data can be released to third parties only if requested in writing by Del Mar Analytical's client. Under certain circumstances and depending on client relationships, a verbal request by a client to release data to a third party may be honored. However, a verbal request must be approved by the President/Laboratory Director and documented in writing.

**Figure 6-1
Non-Disclosure Agreement**

**MEMO TO ALL DEL MAR ANALYTICAL EMPLOYEES REGARDING CONFIDENTIAL
COMPANY INFORMATION**

This is an informational memo which is distributed annually in order to remind you that the work we do is confidential. Items listed below are not to be discussed with people who are not Del Mar Analytical employees.

Client Related Items

1. Our client's laboratory reports are confidential. We have legally binding contracts with many clients in which we agree to maintain the confidentiality of their data. In all cases, the client's permission is required before data can be reported to someone other than the client (including regulators and the client's client). A written record of the verbal permission being given by the client must be maintained.
2. The names of sites and contracts we are working on are confidential.
3. Client lists, client codes, client files, addresses, phone numbers and key contacts are all confidential information, as are any particular likes or dislikes of a client. In addition, billing information, including special pricing structures and quotes are confidential.

Operations Items

1. Del Mar Analytical's organization structure is confidential. Titles and job descriptions are not confidential, but specifics about the hierarchy and the printed organization charts are confidential.
2. Details about compensation are confidential. Employees are advised to refrain from discussing their compensation with each other. Employees who have access to payroll information are not permitted to discuss that information with any employee or non-employee except the Laboratory Director, Laboratory Manager, or Office Manager.
3. Performance reviews and personnel information/data are confidential. Employees who have information regarding employee's personal life, financial situation and/or the employee's career objectives are to consider the information confidential. The information is not to be disclosed to non-employees, nor should it be discussed with employees other than the Laboratory Director, Laboratory Manager, or Office Manager.
4. References on the performance of former employees are confidential and can only be given by the Laboratory Director, Laboratory Manager, or Office Manager.
5. Marketing strategies are confidential.
6. Technical improvements to methods, instruments or data reduction techniques are confidential.
7. Software applications authored by Del Mar Analytical employees are company property and are not to be removed from the building by any employee, including the author, without written permission. This restriction includes but is not limited to the programs for invoicing, sample control, report generation and QA/QC reports.

Please acknowledge that you have received this notice by signing below.

Signature: _____ Date: _____

7.0 EQUIPMENT AND FACILITIES

At approximately 24,000 square feet, Del Mar Analytical's Irvine Laboratory is one of the largest environmental laboratories in California. Del Mar Analytical's satellite laboratories include the Colton laboratory at approximately 3,500 square feet, the Van Nuys laboratory at approximately 4,800 square feet, and the Tempe laboratory at approximately 2,500 square feet. The square footage of each laboratory is comprised of both laboratory and office space. Within each laboratory are areas dedicated to specific functions including sample receipt, sample preparation, sample analysis, sample storage, sample archive, data archive, and report preparation. Laboratory floorplans are presented in Figures 7-1 through 7-4.

Each laboratory facility is equipped with safety equipment, including emergency showers, eye wash stations, fire blankets, fire extinguishers, fume hoods, respirators, safety glasses, spill cleanup kits and warning signs.

Del Mar Analytical purchases state-of-the-art analytical instrumentation for sample analyses. With multiple gas chromatograms (GC), gas chromatogram/mass spectrometers (GC/MS), atomic absorption spectrophotometers (AA), inductively coupled plasma spectrophotometers (ICP), infra-red spectrophotometers (IR) and many other analytical instruments, Del Mar Analytical can meet most project needs without subcontracting work to other laboratories. Del Mar Analytical has a policy of upgrading older analytical equipment to minimize down-time and to ensure that samples are analyzed by the best available technology. A list of the major laboratory instrumentation for each Del Mar Analytical laboratory is presented in Tables 7-1 through 7-4.

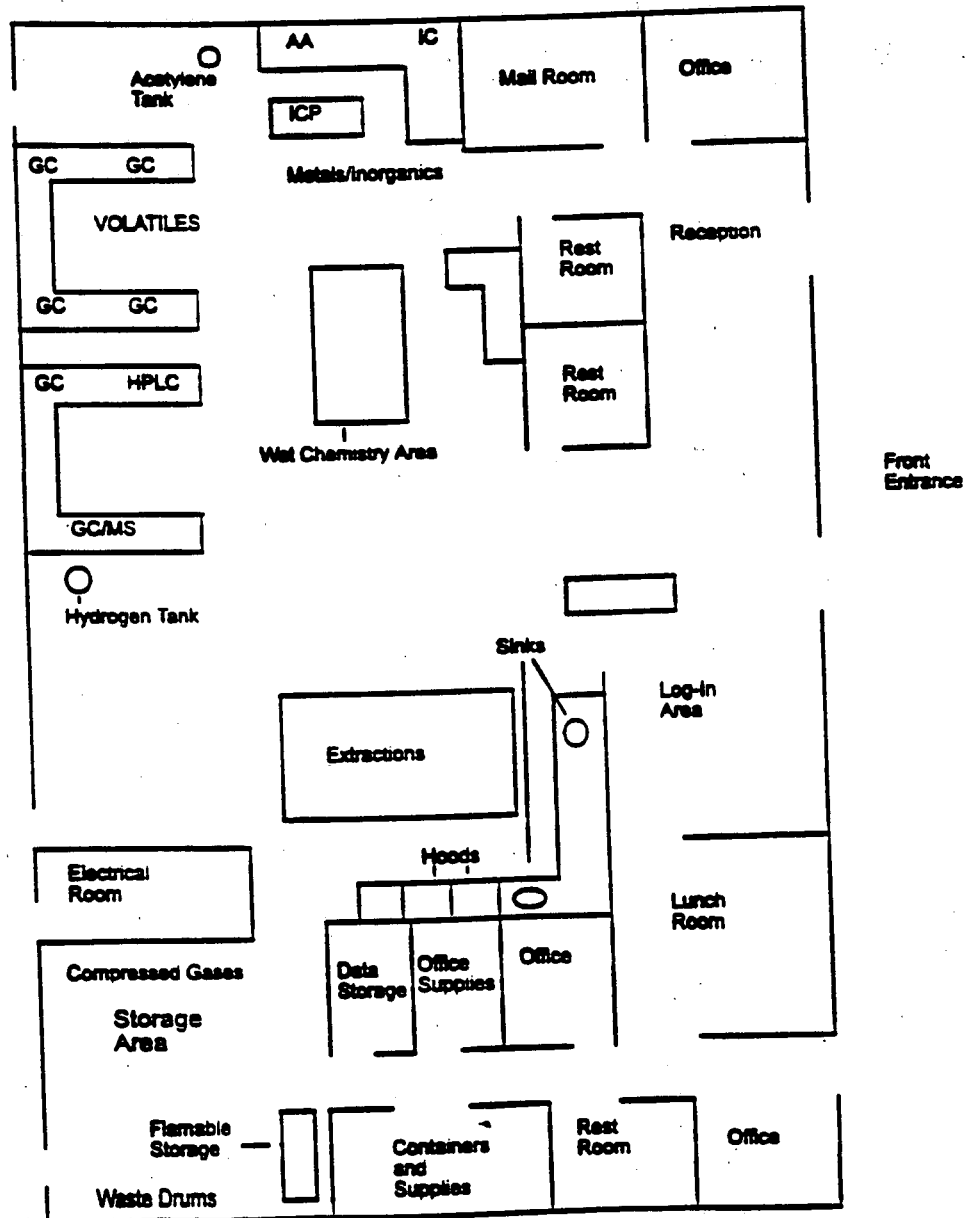
The floor plan of the Environmental Sciences Laboratory is divided into several functional areas:

- Top Section:** Includes a Lobby, Mail Room, Project Manager (two), Lab Supervisor, Conference Room, Sales, and Accounting.
- Central Section:** Features a large central area labeled "Offices" with radiating lines connecting to various support rooms: PA, CIS, Project Manager, Modern, and a large "Extractions" area. To the left are Storage, Extractions, and a TCLP (Toxicity Characterization Leachability Procedure) area.
- Right Section:** Contains a Lab Director's office, a Lunch Room, and a Sample receiving area.
- Bottom Section:** Dedicated to analytical equipment, including:
 - Refrigerators:** A row of numbered refrigerators (1-12) used for sample storage.
 - GCMS & GC:** Gas Chromatography-Mass Spectrometry and Gas Chromatography equipment.
 - Volatiles:** A dedicated area for volatile sample analysis.
 - Semi-volatile GCMS:** Equipment for semi-volatile compound analysis.
 - Inorganics:** Equipment for inorganic analysis.
 - Metals:** Equipment for metal analysis.
 - Sample archive:** A storage area for analyzed samples.

APPROX. 25,000 Square Feet

Figure 7-2
Colton Floorplan

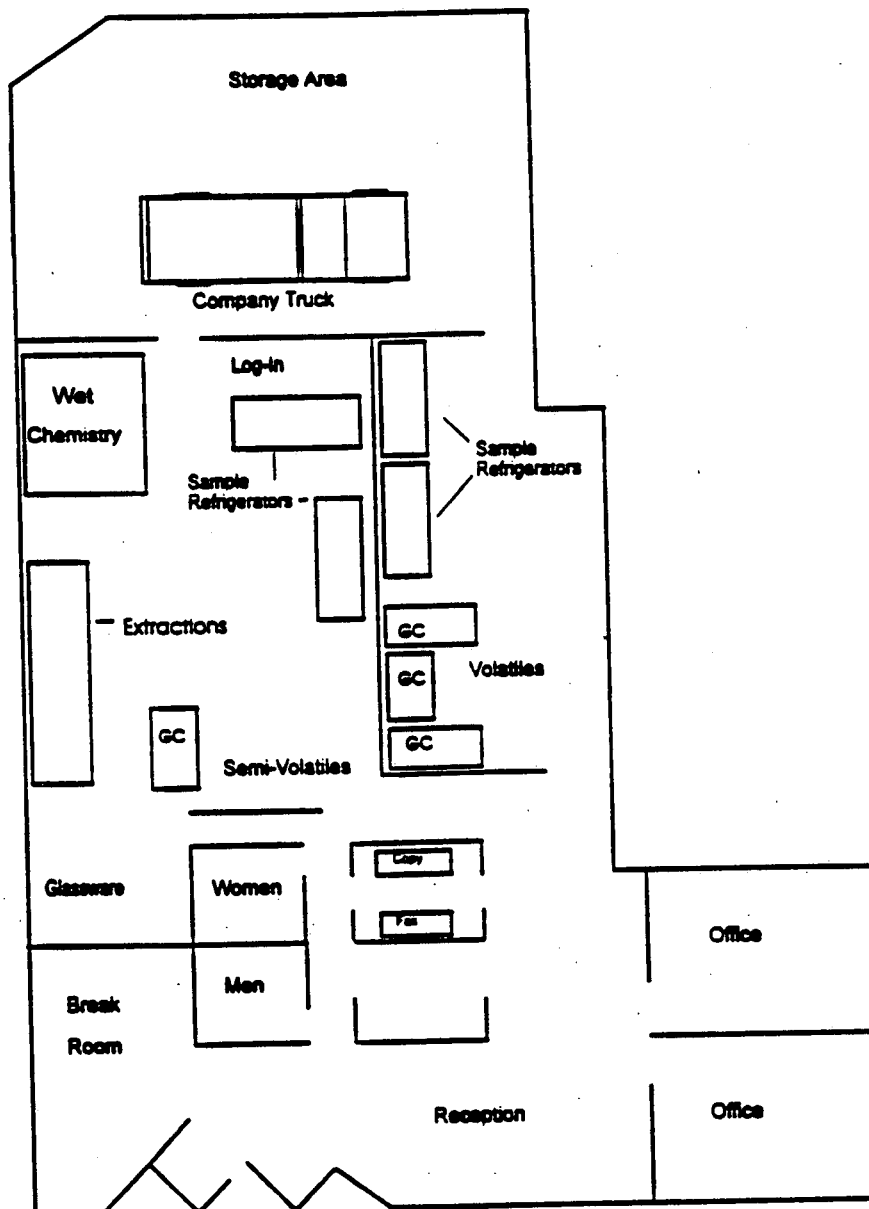
DEL MAR ANALYTICAL - COLTON FLOORPLAN



Approximately 5,000 Square Feet

Figure 7-3
Van Nuys Floorplan

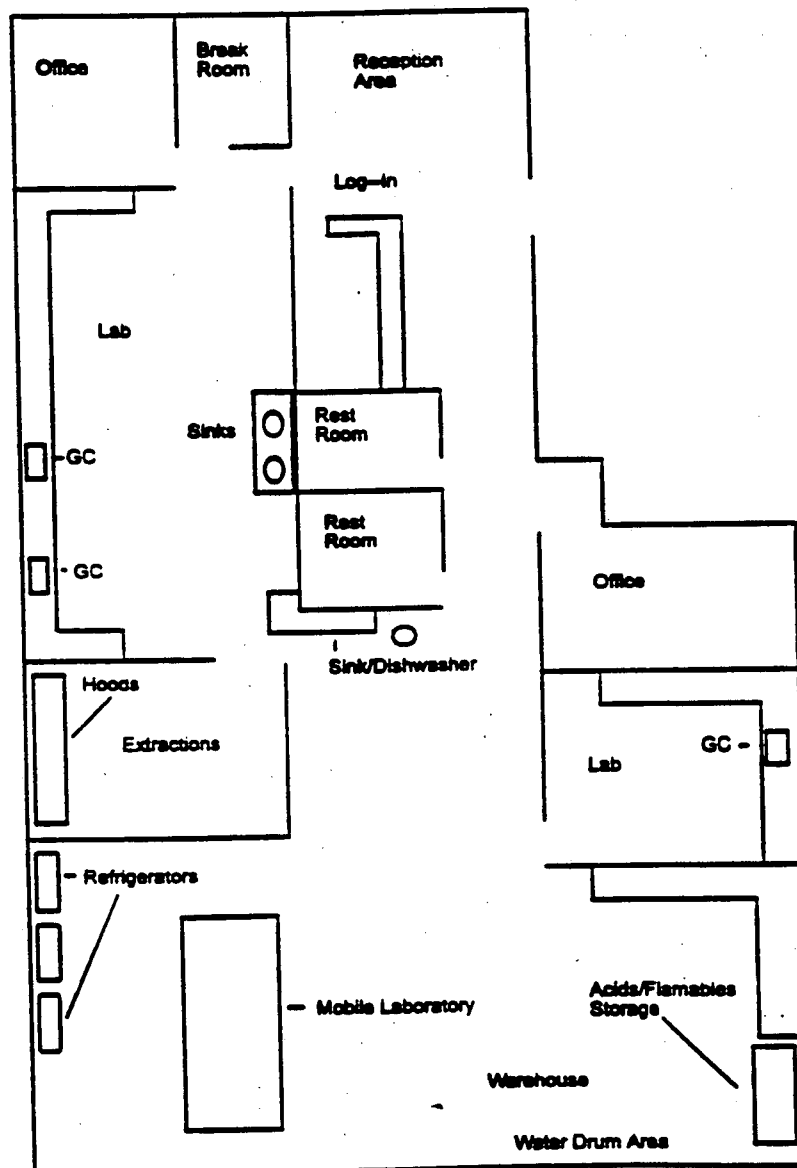
DEL MAR ANALYTICAL - VAN NUYS FLOORPLAN



Approximately 4,800 Square Feet

Figure 7-4
Tempe Floorplan

DEL MAR ANALYTICAL - TEMPE FLOORPLAN



Approximately 3,670 Square Feet

Table 7-1
Irvine Laboratory Instrumentation

Equipment List
Del Mar Analytical, Irvine

<u>ITEM</u>	<u>BRAND</u>	<u>MODEL</u>
Gas Chromatograph #1	Varian	3400
Mass Spectrometer #1	Finnigan	Incos50
Purge & Trap Concentrator #1	Tekmar	LSC2000
Auto Sampler #1	Tekmar	ALS2016
Gas Chromatograph #2	Varian	3400
Mass Spectrometer #2	Finnigan	Incos50
Purge & Trap Concentrator #2	Tekmar	LSC2000
Auto Sampler #3	Tekmar	ALS2016
Gas Chromatograph	Hewlett Packard	5890A
MSD Mainframe	Hewlett Packard	5971
Auto Sampler	Hewlett Packard	7673a
Gas Chromatograph #1	Hewlett Packard	5890
Auto Sampler #1	Hewlett Packard	7673A
Gas Chromatograph #2	Hewlett Packard	5890
Auto Sampler #2	Hewlett Packard	7673A
Gas Chromatograph #3	Perkin Elmer	8500
Auto Sampler #3	Perkin Elmer	AS8300
Gas Chromatograph #6	Perkin Elmer	Sigma 300
Purge & Trap Concentrator #6	Tekmar	LSC2000
Gas Chromatograph #7	Perkin Elmer	8500
Headspace Autosampler #7	Perkin Elmer	HS-101
Gas Chromatograph #8	Hewlett Packard	5890
Gas Chromatograph #9	Hewlett Packard	5890
Purge & Trap Concentrator #9	O.I. Analytical	4460A

Table 7-1 (continued)

Equipment List
Del Mar Analytical, Irvine

<u>ITEM</u>	<u>BRAND</u>	<u>MODEL</u>
Auto Sampler #9	O.I. Analytical	MPM16
Gas Chromatograph #10	Hewlett Packard	5890
Purge & Trap Concentrator #10	O.I. Analytical	4460A
Auto Sampler #10	O.I. Analytical	MPM-16
Gas Chromatograph #11	Hewlett Packard	5890
Purge & Trap Concentrator #11	O.I. Analytical	4460A
Auto Sampler #11	O.I. Analytical	MPM-16
Gas Chromatograph #12	Hewlett Packard	5890
Auto Sampler #12	Hewlett Packard	7673A
Gas Chromatograph #14	Hewlett Packard	5890
Purge & Trap Concentrator #14	O.I. Analytical	4460A
Auto Sampler #14	O.I. Analytical	MPM-16
TOC Analyzer	O.I. Analytical	700
Auto Sampler	Dionex	AS
Balance	Mettler	AE100
Conductance Meter	Yellow Springs	32
Ion Chromatograph	Dionex	4500
pH Meter	Beckman	PH140
Turbidity Meter	Shaban	20010
UV/VIS Spectrophotometer	Milton Roy Co.	Spec. 200
Atomic Absorption Spectrophotometer	Perkin Elmer	5100PC
Atomic Absorption Spectrophotometer	Perkin Elmer	3100
Auto Sampler	Perkin Elmer	AS900
Auto Sampler	Perkin Elmer	AS-60

Table 7-1 (continued)

Equipment List
Del Mar Analytical, Irvine

<u>ITEM</u>	<u>BRAND</u>	<u>MODEL</u>
Cold Vapor System	Perkin Elmer	FIAS200
Mercury Analyzer	Perkin Elmer/FIMS	
Inductively Coupled Plasma Spectrophotometer	Perkin Elmer	P-40
Inductively Coupled Plasma Spectrophotometer	Optima 3000XL	
Balance	Sartorius	8610-OUR
Balance	Mettler	PJ3600
Conductivity Meter	Corning	M90
Fixed Wavelength Infrared Spectrophotometer	Foxboro	Miran1FF
Flashpoint Tester	Koehler	K-162
Fourier Transform Infrared Spectrophotometer	Analect	RFX-30
Muffle Furnace	Lindberg	51442/59344
pH Meter	Beckman	PHL-32
Recirculating Bath	Lauda	RM90
Rotary Evaporator	Buchi	RE111
Sonic Disruptor	Tekmar	TM500
Turbo Evaporator	Zymark	ZW640-3R
Turbo Evaporator	Zymark	ZW640-1
Waterbath	Buchi	B-461

Table 7-2
Colton Laboratory Instrumentation

Equipment List
Del Mar Analytical, Colton

<u>ITEM</u>	<u>BRAND</u>	<u>MODEL</u>
Atomic Absorption Spectrophotometer	Perkin Elmer	Flame: 2380
Atomic Absorption Spectrophotometer	Perkin Elmer	Furnace: HGA220
Atomic Absorption Spectrophotometer	Perkin Elmer	Hydride: MHS-10
Ion Chromatograph	Wescan	
Inductively Coupled Plasma Spectrophotometer	Baird	ICP-2000
Spectrophotometer	Milton Roy	Spectronic-20D
pH Meter	Beckman	PH41
Fixed Wavelength Infrared Spectrophotometer	Foxboro	Miran1FF
Flashpoint Tester	Herzog	Tag Closed Cup
Sonicator	Fisher Scientific	50
Nephelometer	HF Instruments	DRT100B
Conductivity Meter	YSI	35
Rotator	Millipore	
Balance #1	American Scientific Products	S/P 180
Balance #2	Sartorius	PT-600-OUR
Balance #3	Sartorius	PT-600-00VI
Vortex	Baxter Scientific	SuperMixer2
Centrifuge	International Equipment	HN
Zero Headspace Extract	Gelman Scientific	
Turbo Evaporator	Zymark	ZW640-1
High Performance Liquid Chromatograph	Hewlett Packard	HPLC 1050
Ultra Violet Detector	Hewlett Packard	
Fluorescence Detector	Hewlett Packard	1046A

Table 7-2 (continued)

Equipment List Del Mar Analytical, Colton		
<u>ITEM</u>	<u>BRAND</u>	<u>MODEL</u>
Auto Sampler		
Pickering Reaction Module		
Gas Chromatograph #1	Hewlett Packard	5890
Purge & Trap Concentrator #1	Tekmar	LSC2000
Auto Sampler #1	Tekmar	ALS2016
Gas Chromatograph #2	Hewlett Packard	5890 Series II
Auto Sampler #2	Hewlett Packard	
Gas Chromatograph #3	Hewlett Packard	5890 Series II
Purge & Trap Concentrator	O.I. Analytical	MPM16
Purge & Trap Concentrator #3		4460A
Gas Chromatograph #4	Hewlett Packard	5890 Series II
Auto Sampler #4	Hewlett Packard	7673
Gas Chromatograph #5	Hewlett Packard	5890
Gas Chromatograph/Mass Spectrometer	Varian	3400
Purge & Trap Concentrator	Tekmar	LSC2000
Auto Sampler	Tekmar	ALS2016
Mass Spectrophotometer	Finnigan	INCOS50
Auto Sampler	Finnigan	A200S

Table 7-3
Van Nuys Laboratory Instrumentation

Equipment List Del Mar Analytical, Van Nuys		
<u>ITEM</u>	<u>BRAND</u>	<u>MODEL</u>
Gas Chromatograph #1	Hewlett Packard	5890
Controller	HNU	PI-52
Auto Sampler #1	O.I. Analytical	MPM-16
Link #1	Perkin Elmer Nelson	900 Series
Purge & Trap Concentrator	O.I. Analytical	4560
Gas Chromatograph #4	Hewlett Packard	5890 Series II
Auto Sampler #4	O.I. Analytical	MPM-16
Purge & Trap Concentrator	O.I. Analytical	4460A
Link #2	Perkin Elmer Nelson	600 Series
Gas Chromatograph #2	Hewlett Packard	5890 Series II
Auto Sampler #2	O.I. Analytical	MPM-16
Purge & Trap Concentrator	O.I. Analytical	4560
Lamp Power #1	O.I. Analytical	4430
Lamp Power #2	O.I. Analytical	4430
Integrator	Hewlett Packard	3396A
Gas Chromatograph #3	Hewlett Packard	5890 Series II
Auto Sampler #3A	Hewlett Packard	7673
Auto Sampler #3B	Hewlett Packard	7673
Link #3	Perkin Elmer Nelson	600 Series
Controller	Hewlett Packard	7673
Centrifuge	Fisher Scientific	Turbo
Mult. Probe	Jenco	6071
Fixed Infrared Spectrometer	Foxboro	Miran1FF
Turbo Evaporator	Zymark	Turbo II

Table 7-3 (continued)

Equipment List
Del Mar Analytical, Van Nuys

<u>ITEM</u>	<u>BRAND</u>	<u>MODEL</u>
Vortex	Baxter Scientific	S8223-1
Orbiter	Lab-Line	Constant
Balance #1	Sartorius	Portable
Balance #2	Sartorius	Handy

Table 7-4
Tempe Laboratory Instrumentation

Equipment List
Del Mar Analytical, Tempe

<u>ITEM</u>	<u>BRAND</u>	<u>MODEL</u>
Gas Chromatograph #1	Hewlett Packard	5890
Gas Chromatograph #2	Hewlett Packard	5890
Purge & Trap Concentrator	O.I. Analytical	MPM-16
Auto Sampler #2	Hewlett Packard	7573
Purge & Trap Concentrator	Zymark	Turbovap
Balance	Mettler	AE260
Fixe Wavelength Infrared Spectrophotometer	Horiba	OCMA220
Gas Chromatograph #1	Perkin Elmer	8500
Sample Concentrator	Various	
Gas Chromatograph #2	Hewlett Packard	5890 II
Purge & Trap Concentrator	O.I. Analytical	4460A
Auto Sampler	O.I. Analytical	MPM-16
Sonicator	Sonics & Materials	VC600-2
Ultrasonic Bath	Brasonic	5200
pH Meter	Orion	501
Conductivity Meter	YSI	35
Hot Plate	VWR Scientific	Dylatherm
Hot Plate	Fisher Scientific	200T
Mechanical Shaker	Lab-Line	3506
Gas Chromatograph #3	Hewlett Packard	5890
Fixed Wavelength Infrared Spectrophotometer	Horiba	OMCA220
Purge & Trap Concentrator	Tekmar	2000
Auto Sampler	Tekmar	2016

8.0 SAMPLING

Sampling is an important part of any analysis. The result may be only as useful as the quality of the sampling effort. While the majority of Del Mar Analytical's clients assume the responsibility for developing and implementing a sampling plan, Del Mar Analytical is capable of a variety of field sampling procedures.

8.1 SAMPLING CONTAINERS AND PRESERVATION

Containers are purchased in large lots from various commercial sources and are equivalent, in terms of construction materials and cleaning protocols, to those listed in the Federal Register, October 26, 1984 and SW-846 Revision 1 December 1987. Containers are prepared in a designated area, labelled with a sample label which indicates the added preservative and then stored. Samples brought to Del Mar Analytical by clients who have done their own sampling, are appropriately preserved and stored in refrigerators upon arrival. Preparation of containers is done by technicians relying on Standard Operating Procedures for Bottle Preservation. Bottles for organics analyses are purchased from suppliers who certify the containers to have been cleaned by protocols as prescribed in the EPA methods for organics analyses. As part of the analytical process, sample containers are provided to clients with the appropriate preservatives free of charge. A sample container and preservative guide can be found in Table 8-1.

8.2 SAMPLE COLLECTION

Del Mar Analytical technicians collect samples under the direction of the client or the regulating authority. There are standard operating procedures for sampling of monitoring wells, 24-hour automatic composite sampling, bacteriological sampling, and basic field parameters. Standard operating procedures include a list of all the equipment necessary to perform the sampling, detailed instructions about the use and calibration of the instruments and sampling procedures, as well as instructions on decontaminating the equipment and necessary field quality control measures. The field technician takes a copy of the standard operating procedures along with his field sampling data sheets as part of his reference materials.

Equipment is inspected before each use to ensure that it functions properly. Field instruments are calibrated in the laboratory before each sampling event. Appropriate sample containers, personal safety gear, sampling devices and temporary storage coolers are checked for cleanliness and proper working conditions before each use.

Table 8-1
Sample Container and Preservative Guide

SAMPLE CONTAINER AND PRESERVATIVE GUIDE					
	METHOD	CONTAINER	VOLUME	PRESERVATIVE	HOLDING TIME
Volatile Organic Chemistry					
(VFH) Gasoline	8015 Mod./BLS-191	VOA-glass	2 40ml vials	Cool 4°C	7 days*/14 soil
(VFH) Gasoline/BTEX	8015 Mod./8020	VOA-glass	2 40ml vials	Cool 4°C	7 days*/14 soil
Halocarbons	601/8010	VOA-glass	2 40ml vials	Cool 4°C	14 days
Aromatics	602/8020	VOA-glass	2 40ml vials	Cool 4°C	7 days*/14 soil
Purgeables	624/8240/8260	VOA-glass	2 40ml vials	Cool 4°C	7 days*/14 soil
Trihalomethanes	502.2	VOA-glass	2 40ml vials	Cool 4°C	7 days*/14 soil
Volatile Organic Compounds	524.2	VOA-glass	2 40ml vials	Cool 4°C	7 days*/14 soil
* To extend the Holding Time to 14 days, prepare bottle with HCL to pH<2.					
Semi-Volatile Organic Chemistry					
(EFH) Diesel	8015 Mod./BLS-191	glass-amber	1L	Cool 4°C	7 days**/14 soil
EDB & DBCP	504	VOA-glass	3 40ml vials	Cool 4°C, HCl	28 days
Semi-Volatiles (BNAs)	625/8270	glass-amber	1L	Cool 4°C	7 days**/14 soil
Pesticides & PCBs	608/8080	glass-amber	1L	Cool 4°C	7 days**/14 soil
Phosphorous Pests.	614/622/8140	glass-amber	1L	Cool 4°C	7 days**/14 soil
Herbicides	615/8150	glass-amber	1L	Cool 4°C	7 days**/14 soil
Polynuclear Aromatics	8310	glass-amber	1L	Cool 4°C	7 days**/14 soil
Carbamate Pesticides	632	glass-amber	1L	Cool 4°C	7 days**
** Holding Times shown are days until extraction. Samples have a 40 day Holding Time after extraction.					
Organic Chemistry					
Total Organic Carbon	415.2/9060	VOA-glass	1 40ml vial	Cool 4°C, H ₂ SO ₄ pH<2	28 days
Total Organic Halides (TOX)	9020	poly or glass	500ml	Cool 4°C, H ₂ SO ₄ pH<2	28 days
Metal Analyses					
Mercury	245.2/7471	poly	500ml	HNO ₃ to pH<2	28 days
Chromium VI	218.4/7196	poly	500ml	Cool 4°C	24 hours***
Organic Lead	CA DHS (LUFT)	glass-amber	1L	Cool 4°C	14 days
All Other Metals	200/6000/7000	poly	500ml	HNO ₃ to pH<2	6 months
*** Indicates 24 hour Holding Time from extraction or sample preparation					

Table 8-1 (continued)

SAMPLE CONTAINER AND PRESERVATIVE GUIDE					
	METHOD	CONTAINER	VOLUME	PRESERVATIVE	HOLDING TIME
Inorganic & Wet Chemistry					
Alkalinity	310.1	poly or glass	500ml	Cool 4°C	14 days
Ammonia (as N)	350.3	poly or glass	500ml	Cool 4°C, H ₂ SO ₄ to pH<2	28 days
BOD	405.1	poly or glass	1L	Cool 4°C	48 hours
COD	410.4	poly or glass	500ml	Cool 4°C, H ₂ SO ₄ to pH<2	28 days
Chloride	300.0	poly or glass	None	None	28 days
Chlorine Residual	330.5	poly or glass	200ml	None	Immediate
Cyanide	335.1/335.2/9010	poly or glass	1L	Cool 4°C, NaOH to pH>12****	14 days
Flashpoint	1010	poly or glass	100ml	Cool 4°C	NA
Fluoride	300.0/340.2	poly or glass	500ml	None	28 days
Hardness	SM2340B	poly or glass	500ml	HNO ₃ or H ₂ SO ₄ to pH<2	6 months
MBAS (Surfactants)	425.1	poly or glass	500ml	Cool 4°C	48 hours
Nitrate or Nitrite	300.0	poly or glass	500ml	Cool 4°C	48 hours
Oil & Grease	413.1/413.2	glass-amber	1L	Cool 4°C, HCl to pH<2	28 days
Ortho Phosphate	300.0	poly or glass	100ml	Cool 4°C, Filter	48 hours
Phenols	420.1	glass-amber	1L	Cool 4°C, H ₂ SO ₄ to pH<2	28 days
Phosphorous	365.2	poly or glass	500ml	Cool 4°C, H ₂ SO ₄ to pH<2	28 days
pH	150.1	poly or glass	500ml	None	Immediate
Solids (TDS, TSS, TS)	160.1/160.2/160.3	poly or glass	1L	Cool 4°C	7 days
Specific Conductance	120.1	poly or glass	500ml	Cool 4°C	28 days
Specific Gravity	SM2710F	poly or glass	500ml	None	NA
Sulfate	300.0	poly or glass	500ml	Cool 4°C	28 days
Sulfide	376.2	poly or glass	500ml	Cool 4°C, Zn Acetate+NaOH pH>9	7 days
Surfactants or MBAS	425.1	poly or glass	500ml	Cool 4°C	48 hours
TKN	351.4	poly or glass	500ml	Cool 4°C, H ₂ SO ₄ to pH<2	28 days
TOC	415.2	VOA-glass	40ml	Cool 4°C, H ₂ SO ₄ to pH<2	28 days
TRPH	418.1/BLS-181	glass-amber	1L	Cool 4°C, HCl to pH<2	28 days
Turbidity	180.1	poly or glass	100ml	Cool 4°C	48 hours
Microbiological Chemistry					
Bioassay (Effluent)	600/4-85/01	poly or glass	10 Gallons	Cool 4°C	36 hours
Bioassay (Haz. Waste)	Title 22/26	poly or glass	1L [†]	Cool 4°C	36 hours

**** If chlorinated, add 0.5g Ascorbic Acid † For soil or hazardous waste samples, at least 100g are needed.

Soil samples are typically collected in brass tubes and wide mouth jars (4 oz. and 9 oz. are available).

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After collection, the samples are placed in a cooler with blue ice and temporarily stored until returned to the laboratory. When requested, a trip blank is prepared before sampling and accompanies the containers out to the sampling site and back to the laboratory in the same cooler.

9.0 CHAIN OF CUSTODY

The chain-of-custody form is the written documented history of any sample. This form is completed at the site by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the chain-of-custody form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. An example of Del Mar Analytical Analytical's chain-of-custody form may be found in Figure 9-1.

9.1 FIELD DOCUMENTATION

At the sampling site, each sample is labelled with the client's sample identification, the date and time of sampling, the name of the client, the name of the sampler, and any other pertinent information. During the sampling process, the chain-of-custody form is completed with the address and phone number of the client, the analyses requested, the containers and preservatives used, and the sampling date and time. The samples are stored in a cooler with blue ice and remain solely in the possession of the field technician until the samples are returned to the laboratory. The field technician relinquishes the samples in writing on the chain-of-custody form to the sample control personnel.

9.2 LABORATORY RECEIPT DOCUMENTATION

When the samples are received at the laboratory, Sample Control personnel check to ensure that all samples listed on the chain-of-custody are present and in acceptable condition. After inspecting the samples, the sample control personnel sign and date the Chain-of-Custody form, make any necessary notes of the samples' conditions (see section 9.3) and store them in appropriate refrigerators.

If samples are received without a chain-of-custody form, Del Mar Analytical will provide a generic chain-of-custody form to be completed by the client when the samples are brought to the laboratory. The client is always provided with a copy of the completed chain-of-custody form for his or her records.

9.3 SAMPLE INTEGRITY DOCUMENTATION

Sample Control personnel check all samples to ensure that method criteria are met. This criteria includes sample volumes, sample containers, preservatives, temperature, and presence of headspace. If analyses with short holding times are required, the dates are inspected to ensure that holding times have not been already violated.

Figure 9-1
Chain-of-Custody Form

[illegible]

Sample Control personnel are also responsible for the compositing of samples and splitting of samples which have multiple analyses or subcontracted analyses requested. These parameters are documented on the form shown in Figure 9-2. Problems with sample integrity or paperwork inconsistencies are reported to the Project Manager for corrective action.

9.4 SAMPLE LOG-IN

Upon receipt at Del Mar Analytical, each sample is given a unique sample number and stored appropriately in matrix specific refrigerators. Separate refrigerators exist for drinking water samples and volatile samples. Each of these unique sample numbers are entered in a Laboratory Information Management System (LIMS) along with the client's name, the project name, the analyses requested, the turnaround status, the due date and any specific instructions regarding detection limits, hazardous materials, QC, or other pertinent information. The LIM system cross references the information in a variety of formats. Each Analyst can print out his or her own work list at any time. Furthermore, the Project Managers have access to the same information.

9.5 SAMPLE STORAGE

From the time of receipt until all analyses are complete, samples are stored in matrix specific refrigerators. Analysts and technicians retrieve the sample container allocated to their analysis from the designated refrigerator, analyze the sample, and return the remaining sample or empty container to the refrigerator from which it originally came. All samples are kept in the refrigerators for four weeks, which meets or exceeds most sample holding times. After four weeks the samples are moved to a dry sample archive area where they are stored for four additional weeks before they are disposed. This eight week holding period allows samples to be checked if a discrepancy or question arises. Upon request, samples may be stored in excess of six months at the laboratory. This extended holding period allows additional metal analyses to be performed on the archived sample and assists clients in dealing with legal matters or regulatory issues.

9.6 HAZARDOUS SAMPLES

To minimize exposure to personnel and to avoid potential accidents, hazardous samples are stored in an isolated area designated for hazardous waste only. Hazardous samples are divided according to hazard, and labelled with a strip of red sticker on the container. After analysis, the level of the contaminant is written on the red sticker and on a Hazardous Sample Notice form like the one presented in Figure 9-3. All hazardous samples are either returned to the client or disposed of appropriately through a hazardous waste disposal firm that lab-packs all hazardous samples and removes them from the laboratory.

CLIENT NAME: _____ PROJECT: _____ DATE: _____
DMA PROJECT MANAGER: _____ RECEIVED BY: _____

Check the Appropriate Response(s):	SAMPLE DESCRIPTION	SAMPLE I.D. #	REMARKS: (CONDITION, ETC.)
	<input type="checkbox"/> Custody Seals Broken		
<input type="checkbox"/> Absent Chain of Custody			
<input type="checkbox"/> Absent Sample Labels			
<input type="checkbox"/> Sample Labels not Listed on C.O.C.			
<input type="checkbox"/> Sample Labels do not Correspond with C.O.C.			
<input type="checkbox"/> Sample has Headspace			
<input type="checkbox"/> Sample is Leaking			
<input type="checkbox"/> Sample is Broken			
<input type="checkbox"/> Collection Dates not Listed on C.O.C.			
<input type="checkbox"/> Collection Dates do not Correspond With C.O.C.			
<input type="checkbox"/> Improper Sample Container			
<input type="checkbox"/> Insufficient Amount of Sample			
<input type="checkbox"/> Improper Preservatives Used			
<input type="checkbox"/> Expired Holding Time			
<input type="checkbox"/> Other			

Figure 9-3
Hazardous Sample Notice

HAZARDOUS SAMPLE NOTICE

DATE: _____

LOG#: _____

CLIENT: _____

PROJECT: _____

___ SAMPLE POTENTIALLY HAZARDOUS

___ SAMPLE HAZARDOUS

SAMPLE ID	SAMPLE DESCRIPTION	HAZARD: COMPOUND & RESULT

These samples need to be tagged and separated accordingly.

Initials: _____

9.7 SAMPLE SHIPPING

In the event that Del Mar Analytical needs to ship samples, the samples are placed in a cooler with enough blue ice to ensure the that the samples remain at 4°C. The samples are carefully surrounded by packing material to avoid breakage, and a trip blank is enclosed for those samples requiring volatile organic analyses. The chain-of-custody form is signed by the courier and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a Del Mar Analytical courier to maintain sample integrity. Del Mar Analytical staffs full-time couriers at each facility. These couriers are trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. Courier service is provided free of charge.

10.0 ANALYTICAL METHODS AND STANDARD OPERATING PROCEDURES

Del Mar Analytical adheres to the test methods as prescribed in EPA SW-846 Revision 1, 1987 for the majority of its analytical procedures. Other method references may include the EPA Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (EPA 600 Series), EPA Methods for the Determination of Organic Compounds in Drinking Water (EPA 500 Series), California Title 22 Code, California AB 1803, Code of Federal Regulations 40, Luft Manual and Standard Methods, 18th Edition, 1992. Some of these methods have been modified and documented in the standard operating procedures used by Del Mar Analytical. It is our policy to modify methods only when the modification has shown to increase the efficiency and/or accuracy of the method without affecting the quality control. Any modification is tested to determine viability, and is only used after being approved by the Quality Assurance Officer. Major modifications are approved by all agencies governing the certification of Del Mar Analytical before being implemented.

Standard operating procedures are created for use as a reference for Analysts, and for documenting modifications to established methods. When approved, all standard operating procedures are signed and dated by the Quality Assurance Officer or Department Supervisor. All standard operating procedures are written in a standard format to maintain consistency. Any time a standard operating procedure is amended a new revision is issued with the new date it becomes effective. Table 10-1 is a directory of standard operating procedures for laboratory and clerical personnel.

Table 10-1
Standard Operating Procedures Directory

STANDARD OPERATING PROCEDURES DIRECTORY

STANDARD OPERATING PROCEDURES FOR LABORATORY PERSONNEL

EXTRACTION PROCEDURES

EPA Method 504, EDB & DBCP
EPA Method 608, Pesticides and PCBs in Water
EPA Method 615, Herbicides in Water
EPA Method 625, Semi-Volatile Organic Compounds: Continuous Extraction
EPA Method 625, Separatory Funnel Extraction
EPA Method 8015, Diesel Extraction
EPA Method 8015, Diesel in Water
EPA Method 8015, Jet Fuel Extraction
EPA Method 8080, Florisil Clean-up
EPA Method 8080, Pesticides and PCBs in Soil
EPA Method 8150, Herbicides
EPA Method 8270, Semi-Volatile Organic Compounds Extraction

METHOD EXCEPTIONS

EPA Method 160.1, Total Dissolved Solids
EPA Method 160.2, Total Suspended Solids
EPA Method 160.5, Settleable Solids
EPA Method 300, The determination of inorganic anions in water by Ion Chromatography
EPA Method 418 Modified soil, Total Recoverable Petroleum for SCL 418 Hydrocarbons (Soil)
EPA Method 418 Water, Total Recoverable Petroleum Hydrocarbons (Water)
EPA Method 502.2, Volatile Organic Compounds
EPA Method 601 & 602, Halogenated Volatile Organics (601), Aromatic Volatile Organics (602)
EPA Method 602, Purgeable Aromatics
EPA Method 624, Purgeables
EPA Method 625, Base/Neutral and Acids, Semi-Volatiles by GC/MS
EPA Method 3060, Alkaline Digestion to determine the total conc. of hexavalent chromium in solid wastes
EPA Method 7196, Hexavalent Chromium (Colorimetric Method)
EPA Method 7470, Mercury in liquid waste (Manual cold vapor technique)
EPA Method 7471, Mercury in solid waste (Manual cold vapor technique)
EPA Method 8000, SW-846 Quality Control: Organics
EPA Method 8010/8020, Halogenated Volatile Organics (8010), Aromatic Volatile Organics (8020)
EPA Method 8015 Modified for DHS LUFT Manual, Non-Halogenated Volatile Organics
(Modified for TPH as gasoline)
EPA Method 8015 Modified for DHS LUFT Manual, Total Petroleum Hydrocarbons as Diesel

Table 10-1 (continued)

STANDARD OPERATING PROCEDURES DIRECTORY (Continued)

METHOD EXCEPTIONS (Continued)

EPA Method 8015 Modified for DHS LUFT Manual, Total Petroleum Hydrocarbons Jet Fuel
EPA Method 8020, Aromatic Volatile Organics
EPA Method 8080, Organochlorine Pesticides and PCB's
EPA Method 8240, GC/MS for Volatile Organics
EPA Method 8270, GC/MS for Semi-Volatile Organics (Capillary Column)

MISCELLANEOUS

ASTM D-1946-90, Standard Practice for the Analysis of Reformed Gas by G.C.
Bottle Preservation
EPA Method 415.1, Total Organic Carbon
EPA Method 6010, ICP Metal Analyses
EPA Method 8010/8020 & 601/602, Halogenated Volatile Organics (Supplement)
EPA Method 8015 Modified, Alcohol Scan by GC/FID
EPA Method 8015 Modified Air, Gas/BTEX by G.C. (based on EPA mod-8015/8020)
Glassware Cleaning
Ion Chromatographic Method for Determination of Sulfur
Laboratory Waste Disposal
Purge Water Preparation
Reagent Preparation
Sample Control
Sample Control Training Manual
Sample Result Reporting
Sample Weighing
Significant Figures
Statistician
SW-846 Method 9060, Total Organic Carbon

STANDARD OPERATING PROCEDURES FOR CLERICAL PERSONNEL

Courier
Data Processor
Project Management
Purchasing Agent
Report Processor

11.0 ANALYTICAL QUALITY CONTROL

Quality control measurements verify the integrity of the analytical results. While the goal of all quality control procedures remains constant, specific quality control procedures vary from method to method, and to some extent, with matrix type. Every Analyst is responsible for a thorough understanding of the goals of each quality control measurement and the control analyses as required per method. The Analyst is also responsible for the documentation of all quality control measurements associated with a particular method. All documentation is kept on file and securely stored for a minimum of ten years.

Del Mar Analytical adheres to the quality control procedures as prescribed in EPA SW-846 Chapter 1, Revision 1, 1992 for the majority of its analytical procedures. For projects which require a more in-depth validation of the data, Del Mar Analytical can provide different levels of documentation. For special regulatory or legal defensibility issues, custom data packages can be prepared.

11.1 CALIBRATION

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the detection limits, the working range of the analytical instrumentation and any fluctuations which occur from day to day.

11.1.1 CALIBRATION FOR ORGANIC ANALYSES

EPA Method 8000, from EPA SW-846, Revision 1, December 1987, is a general introduction to the quality control requirements for gas chromatography analyses. Del Mar Analytical follows the quality control measures of EPA Method 8000 for all organic analyses as well as any additional measures required by specific EPA methods. Standard operating procedures for analytical methods and all quality control documentation measures are kept in the Analysts' notebooks and reference binders.

The majority of organic instrumentation is calibrated with internal standards. Because of the complex nature of the multipeak chromatograms produced by the method, some instruments necessitate the use of external standard calibration. Surrogate compounds are included in the calibration processes for all appropriate organic analyses.

Initially, each instrument is calibrated for the appropriate method. Once the operating parameters have been established according to the method, the Analyst prepares five or more standard solutions containing all the analytes of interest, internal standards, and surrogates that are appropriate for the method. These standard solutions are prepared at five different concentrations. One of the concentrations is at, or just above, the detection limit, and the other four should define the linear range for the instrument. All of the standard solutions are prepared using volumetric glassware and the highest quality solvents and stock standards commercially available. Volatile analyses are calibrated approximately every four weeks, or as necessary to maintain accurate calibration. Semi-volatile analyses are calibrated every six to eight weeks, or as necessary to maintain accurate calibration.

Standards for instrument calibration are obtained from a variety of sources. Dilution standards are prepared from stock standards purchased from commercial suppliers. Any stock standard purchased "neat" (>96% pure) is diluted by weight on an analytical balance using volumetric glassware. A standard log is maintained for each department, containing concentration, date of receipt, date of standard preparation, any dilutions made, lot number, supplier, type of solvent and a unique code number to identify the standard. A standard log is presented in Figure 11-1.

The five standard solutions are introduced into the instrument in the same manner as the sample extract whether it be by direct injection, by headspace analysis, or by purge and trap. The calibration factor (CF) for methods that use external standards, and the response factor (RF) for methods that use internal standards are calculated for the five standards. Calibration Factors and Response Factors for each analyte are calculated as follows:

$$\text{Calibration Factor} = \frac{\text{Total Area of Peak}}{\text{Concentration of Analyte}}$$

$$\text{Response Factor} = \frac{(\text{Area of Analyte})(\text{Conc. of Internal Standard})}{(\text{Area of Internal Standard})(\text{Conc. of Analyte})}$$

The CF or RF for each analyte at each concentration is tabulated to determine the graphical linearity of concentration versus response factor or calibration factor. The five CFs or RFs for each analyte must have a % Relative Standard Deviation (% RSD) of less than 20% for the GC methods and less than 30% for volatile GC/MS methods. The % Relative Standard Deviation is calculated as follows:

$$\%RSD = (SD/x) \times 100$$

[illegible]

Where

SD = Standard Deviation of initial 5 CFs or RFs for each compound calculated as follows:

$$SD = \sqrt{\frac{1}{n-1} \left[\sum_{i=1}^n x_i^2 - \frac{\left(\sum_{i=1}^n x_i \right)^2}{n} \right]}$$

and

\bar{x} = Mean of initial 5 CFs or RFs for each compound.

Alternatively, the least squares method may be used to determine linearity. A five point line must result in .999 or better using the least squares method to be considered linear. The CFs or RFs for each compound are calculated and kept in the Analysts' files.

The validity of the calibration curve must be checked daily for each instrument and more frequently for instruments with particularly sensitive detectors. The Analyst prepares a daily calibration check standard solution in the same manner as the initial calibration standard solution. The concentration of the daily calibration check standard is near the middle of the instrument's linear range. It is, therefore, sometimes referred to as a midpoint standard. If the calibration check standard differs from the calibration curve by more than 15% for the GC methods, 25% for the volatile GC/MS methods or 30% for the semi-volatile GC/MS methods, then the Analyst must take corrective action before samples are analyzed. The percent difference is calculated as follows:

$$\% \text{ Difference} = \frac{(\text{Average CF or RF}) - (\text{Calibration Check CF or RF}) \times 100}{(\text{Average CF or RF})}$$

The initial calibration curve is further verified by the use of a Laboratory Control Sample (LCS). The LCS is a standard from either a different lot number from the same supplier as the calibration standard or a different supplier altogether. The LCS is prepared and analyzed in the same manner as a sample for the same analysis. The LCS result is calculated and compared to the true value of the LCS. The percent difference (% D) between the result and true value is calculated as follows:

$$\% \text{ Difference} = \frac{\text{True Value} - \text{Result} \times 100}{\text{True Value}}$$

The acceptance limits for LCS are different for each method. In each method of EPA SW-846, Revision 1, 1992, tables of QA/QC criteria indicate method acceptance limits which may be applied to the LCS. Del Mar Analytical uses these tables as guidelines for LCS acceptance limits. In addition, LCS Control charts are maintained as well. These control Charts track the recovery of the LCS over time. Warning limits are set at two times the standard deviation of the mean recovery and control limits are set at three times the standard deviation of the mean recovery.

Some methods have prescribed limits for the CF, RF, % RSD and % Difference that may differ from the limits in EPA Method 8000. It should be noted that individual method specifications would take precedence over general procedures. In addition, there may be calibration procedures prescribed in the method, like GC/MS tuning with BFB (4,4-bromofluorobenzene) or DFTPP (decafluorotriphenylphosphine), which are not described here in detail but are described in detail in the standard operating procedures for the method.

11.1.2 CALIBRATION FOR INORGANIC ANALYSES

EPA Method 7000 from EPA SW-846, Revision 1, December 1992, is a general introduction to the quality control requirements for metal analyses. Del Mar Analytical follows the quality control measures established in EPA 7000 for metal analyses. Quality control measures for other inorganic and wet chemistry methods are set out in the individual methods of SW-486, 1992, and in Standard Methods for the Examination of Water and Wastewater" 18th Edition 1992 and Methods for Chemical Analysis of Water and Wastes, 1983. Standard operating procedures for the analysis and the quality control documentation measures are kept in the Analysts' files and reference binders.

The majority of inorganic instrumentation is calibrated with external standards, with the exception of the ICP spectrophotometer for metal analyses which is calibrated with the internal standard, yttrium. The calibration procedures and calculations for inorganics are similar to those of organics. Please refer to section 11.1.1.

11.2 RETENTION TIME WINDOWS

Most organic analyses use gas chromatography or liquid chromatography techniques; some inorganic analyses use liquid chromatography technique as well. For every chromatography analysis, each analyte will have a specific time of elution from the column to the detector. This is known as the analytes's retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte

used for that method. These records are kept with the files associated with an instrument for later quantitation of the analytes.

Once the Analyst has determined that the instrument is in optimum working condition through calibration and calibration verification procedures, then he or she uses a mid-range calibration standard to establish the retention times for each of the individual analytes in a method. The Analyst makes three injections of the same standard over a 72-hour period, tabulating the retention times for each analyte for each of the three injections. The Standard Deviation of the three values for each analyte is calculated as follows:

$$\text{Standard Deviation} = \sqrt{\frac{1}{n-1} \left[\sum_{i=1}^n x_i^2 - \frac{\left(\sum_{i=1}^n x_i \right)^2}{n} \right]}$$

The retention time window is defined as the average retention time \pm 3 Standard Deviations. Alternatively, the Analyst may use the computer software to determine the retention time windows. Both the Perkin Elmer Nelson Turbochrom software and the Hewlett Packard ChemStation software are capable of setting the retention time windows for the Analyst. Using multiple injections of a standard as described, the Analyst may configure the software to determine the retention time window. A peak outside of the retention time window will not be reported as a positive identification by the computer.

11.3 QUANTITATION

Organic analytes analyzed by gas chromatography are identified by comparing retention times of the sample and the standard. Most EPA Methods require that each analyte be confirmed on a second column, one with a different chemistry than the first column. Sample quantitation procedures are outlined in each method depending on the type of calibration used for the method. All calculations and instrumentation parameters are documented in the Analysts' notebooks.

Similarly, inorganic analytes are identified and quantitated by comparing the response of the analyte to the response of the standard. Confirmation is not always possible, although some methods, like metal analyses, allow for a secondary check under a different set of instrument operation parameters. Again, all calculation and instrument operating parameters are recorded in the Analysts' notebooks.

11.4 DETECTION LIMIT VERIFICATION

Method detection limits (MDL) are determined in accordance with 40 CFR 136. The MDL represents the concentration level for each analyte within a method at which the Analyst is 99% confident that the value is not zero. The detection limit is determined for each analyte on an annual basis. The Analyst prepares seven replicates of solution spiked at one to five times the reported detection limit with all the analytes of interest. Each of these aliquots is extracted and analyzed in the same manner as the samples. The standard Deviation (SD) of the replicates is calculated as follows:

$$SD = \sqrt{\frac{1}{n-1} \left[\sum_{i=1}^n x_i^2 - \frac{\left(\sum_{i=1}^n x_i \right)^2}{n} \right]}$$

The detection limit is calculated as follows:

$$\text{Detection Limit} = t_{(n-1, 1-\alpha=0.99)} \times \text{Standard Deviation}$$

where

$$t_{(n-1, 1-\alpha=0.99)} = 3.143 \text{ for seven replicates.}$$

40 CFR 136 requires the analysis of seven replicates on one day only. Del Mar Analytical may choose to repeat the analyses on three non-consecutive days to account for any variances which may occur over time.

11.5 EQUIPMENT MAINTENANCE

Del Mar Analytical is dedicated to providing its clients with state-of-the-art technology. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity.

All instruments have log books in which adjustments, calibrations, routine maintenance, and any repairs are recorded. Service maintenance contracts are in place for many of the instruments for any major repairs. Most routine maintenance is performed by the Analyst or the Technical Manager. The highest quality gases, reagents and spare parts are kept on hand to minimize repair time and optimize instrument performance. By training staff to service their own instruments, preventative maintenance is performed more often thereby keeping the

instruments running better, reducing down-time and preventing Del Mar Analytical from relying on and waiting for technical service from the instrument manufacturers.

Each entry in the instrument log book includes the Analyst's initials, the date, a detailed description of the problem, a detailed explanation of the solution, and a verification that the instrument is functioning properly.

11.6 QUALITY CONTROL

The analytical process is controlled not only by instrument calibration, but by quality control measurements of the labor intensive portions of the analysis as well. These processes involve measurements of blanks, surrogates, accuracy and precision. With every analytical batch, a method blank, Laboratory Control Samples (LCS), spike, spike duplicate and surrogates are analyzed to determine the quality of the analytical process per batch of environmental samples. See Table 11-1 for a summary of minimum QC sample requirements.

11.6.1 METHOD BLANK

The method blank must be free of contamination to determine that neither the extraction procedure nor the analytical instrument contributed to the over-estimation of analytes in the environmental samples. With the exception of a few compounds on certain analyses, the method blank should quantitate to a value of less than half the reported detection limit for the analytes of interest. The exceptions are noted in the standard operating procedures for those methods. If unacceptable contamination is present in the method blank, corrective action is taken. Corrective action includes inspecting of the instrument, glassware, syringes and solvents for possible sources of contamination. The Analyst may determine that re-extraction and re-analysis of the sample is necessary prior to reporting the data.

11.6.2 ACCURACY

In the laboratory, accuracy is measured as percent recovery. Accuracy measurements are performed every twenty samples or once every analytical batch per matrix type, whichever contains fewer samples. For each matrix, an environmental sample from the analytical batch is spiked twice with a known quantity of the analyte(s) and analyzed in the same manner as the rest of the analytical batch. These samples are referred to as the matrix spike and matrix spike duplicate (MS/MSD). The % recovery is calculated and documented in a QC Data Report like the one presented in Figure 11-2. Percent recovery is calculated as follows:

$$\% \text{ Recovery} = \frac{(\text{Conc. of Matrix Spike}) - (\text{Conc. of Sample})}{\text{Spike Conc. Added}}$$

Table 11-1
Summary of Minimum Quality Control Requirements

Analysis Type	Method Blank	Laboratory Control Sample	Surrogate Spike	Internal Standard	Matrix Spike/ Matrix Spike Duplicate
Metals Analysis (ICP, GFAA, FAA)	Every Analytical Batch			Every Sample (ICP only)	Once per Analytical Batch
Nonmetallic Inorganic Analyses (IC, Cyanide, other Colorimetric Methods)	Every Analytical Batch	Every Analytical Batch			Once per Analytical Batch
Organic Analysis (TRPH, TOC)	Every Analytical Batch	Every Analytical Batch			Once per Analytical Batch
GC Analyses	Every Analytical Batch	Every Analytical Batch	Every Sample (Only if required by the method)	Every Sample (Only if required by the method)	Once per Analytical Batch
GC/MS Analyses	Every Analytical Batch	Every Analytical Batch	Every Sample	Every Sample	Once per Analytical Batch

Figure 11-2
Quality Control Data Report

QC DATA REPORT

EPA METHOD:
Matrix:

8015 volatile
Water

DATE: 6/13/94

SAMPLE # DF01202

Analyte	R1	Sp	MS	MSD	PR1	PR2	RPD	MEAN PR
	ppb	ppb	ppb	ppb	%	%	%	%
Hydrocarbons	2.8	110	120	120	107%	107%	0.0%	107%

Definition of Terms:

R1..... Result of Sample Analysis

Sp..... Spike Concentration Added to Sample

MS..... Matrix Spike Result

MSD..... Matrix Spike Duplicate Result

PR1..... Percent Recovery of MS: $((MS-R1) / SP) \times 100$

PR2..... Percent Recovery of MSD: $((MSD-R1) / SP) \times 100$

RPD..... Relative Percent Difference: $((MS-MSD)/(MS+MSD)/2) \times 100$

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The mean percent recovery is determined by calculating the average of the matrix spike and the matrix spike duplicate. The warning limits are defined as the average of the mean percent recovery of the most recent spike samples ± 2 standard deviations. Mean percent recovery results outside of the warning limits do not require corrective action unless a trend develops. A trend is defined as three consecutive results which are all above the upper warning limit or all below the lower warning limit. The % recovery of an analyte in a spiked sample must fall within the control limits set for that analyte. The control limits are defined as the average of the mean percent recovery of the most recent twenty spike samples ± 3 standard deviations. Mean percent recovery results outside of the control limits warrant immediate corrective action. Some methods, however, have preset acceptance limits, in which case the limits set by the method may be used. The standard deviation is calculated as follows:

$$\text{Standard Deviation} = \sqrt{\frac{1}{n-1} \left[\sum_{i=1}^n x_i^2 - \frac{\left(\sum_{i=1}^n x_i \right)^2}{n} \right]}$$

11.6.3 PRECISION

Precision is measured as the relative percent difference (RPD) between two values. Precision measurements are performed every twenty samples or once every analytical batch per matrix type, whichever contains fewer samples. Both the matrix spike (MS) and the matrix spike duplicate (MSD) are analyzed in the same manner as rest of the analytical batch. The relative % difference between the two spikes is calculated and documented. The relative % difference is calculated as follows:

$$\text{Relative \% difference} = \frac{(\text{Conc. of MS}) - (\text{Conc. of MSD})}{(\text{Conc. of MS} + \text{Conc. of MSD})/2}$$

The warning limits are defined as the average of the relative percent difference for the most recent twenty matrix spike/matrix spike duplicate pairs ± 2 standard deviations. Relative percent difference results outside of the warning limits do not require corrective action unless a trend develops. A trend is defined as three consecutive results outside of the warning limits. The relative % difference for a particular analyte must fall within the control limit established for that analyte. The control limits are defined as the average relative % difference for the most recent twenty matrix spike/matrix spike duplicate pairs ± 3 standard deviations. Relative percent difference results outside of the control limits warrant immediate corrective action. Some methods, however, have preset acceptance limits, in which case the limits set by the method may be used. The standard deviation is calculated in the same manner as the % recovery of the matrix spike.

11.6.4 QUALITY CONTROL DATA

The matrix spike (MS) and matrix spike duplicate (MSD) are reported by the Analyst on a daily basis. The QA/QC Assistant reviews the QA/QC data and then inputs the data into the computer. If the QA/QC Assistant finds any data that is suspected to be out of control, the QA/QC Officer is notified immediately. The QA/QC Officer then reviews the data and may take appropriate corrective action.

11.6.5 SURROGATES

In majority of organic analyses, surrogate compounds are spiked into all environmental samples, the method blank, matrix spike, and the matrix spike duplicate and act as a secondary check on accuracy. The percent recovery of the surrogate is documented, ensuring that all environmental samples have gone through the analytical process with acceptable uniformity. The control limits for surrogate recovery vary from analysis to analysis. Corrective action must be taken on any surrogate recovery outside of the control limit.

11.6.6 USE OF CONTROL CHARTS

Control charts like the one in Figure 11-3, are updated every twenty entries. The calculations from the latest twenty entries define the control limits until another control chart is established. As long as all the entries are within the control limits the analysis is considered acceptable. Because of the statistical nature of the control limits, it is assumed that one in every twenty entries will be outside the control limits. When this deviance occurs, the Analyst must check all calculations, all quality control measures, and verify that the sample preparation and analysis was performed accurately. If all the analytical measurements are verified as correct, then the deviation is attributed to matrix interference or statistical variances. However, any more than one entry outside the control limits requires a thorough examination of the entire analytical system to determine the source of the system error and to perform the corrective action. Any data belonging to the suspect entry's analytical batch should be reanalyzed.

11.7 MATERIALS

All commercially available materials purchased for use in the analytical process are of the highest purity and quality. These materials include all gases used for gas chromatography; all solvents, acids, and bases used in extraction or digestion, dilution, and standard preparation; stock standards; and any other routinely restocked items. On receipt of any of these items, the lot number from the manufacturer is recorded and the purity of the lot is established through a method blank and or a calibration check. Records are kept in appropriate departments.

Figure 11-3
Control Chart

Control Chart

Method 8015 modified
Matrix: Water

	Date	Sample #	Mean PR	RPD
1	6/1/94	DE02708	104%	0%
2	6/1/94	DE03357	89%	0.00%
3	6/2/94	Blank	97%	24.30%
4	6/2/94	DE03197	84%	4.08%
5	6/4/94	DE03172	102%	0.00%
6	6/6/94	DF00025	109%	0.00%
7	6/4/94	DE03197	100%	0.00%
8	6/6/94	DE03368	95%	8.70%
9	6/7/94	DE03373	93%	9.52%
10	6/8/94	Blank	105%	8.70%
11	6/7/94	DE03303	99%	8.70%
12	6/9/94	DF00107	92%	19.18%
13	6/8/94	DF00257	84%	0.00%
14	6/3/94	DE03356	103%	8.70%
15	6/3/94	DE03256	93%	8.70%
16	6/10/94	DF00833	96%	0.00%
17	6/12/94	Blank	109%	0.00%
18	6/10/94	DF00718	96%	8.70%
19	6/13/94	DF01202	107%	0.00%
20	6/9/94	DF00256	104%	8.00%

AVERAGE OF MEAN PR OR RPD

STDEV X 2

STDEV X 3

Mean PR	RPD
97.92%	5.86%
14.98%	13.73%
22.47%	20.60%

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11.8 GENERAL LABORATORY EQUIPMENT

Balances are checked weekly for accuracy using NBS P-class weights and once per month using NBS S-class weights. These checks are recorded in a log. For measurements which are out of range, the Laboratory Manager is immediately notified. Every year the balances are calibrated by a professional balance calibration company. Refrigerator temperatures are also checked daily and recorded in a log. If the temperature of any refrigerator is out of the acceptable range of $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$, the Laboratory Manager is immediately notified and the temperature is corrected or refrigerator repaired.

12.0 SELECTION OF SUBCONTRACT LABORATORIES

To continue providing the best possible service to its clients, Del Mar Analytical subcontracts to other laboratories analyses it is not certified to perform. These analyses include asbestos testing, bioassay toxicity testing, radioactivity testing, and microbiological testing. These laboratories are chosen based on many criteria: the laboratory's reputation, ability to meet turn-around-times, prices, service and Statement of Qualifications all go into the decision of which subcontract laboratory to use. All subcontracted laboratories must be California State Certified. If the work is performed under the jurisdiction of another state, the subcontract laboratory must be certified in that state. A subcontract laboratory is only used if it has been approved by the Laboratory Director. Whenever possible, analyses unable to be performed at Del Mar Analytical should be sent to its affiliated laboratories. Clients are informed verbally by the Project Manager when an analysis will be subcontracted to another laboratory. If a client does not give consent, every effort is made to satisfy the client. If necessary, samples are immediately returned to the client, and references are given to the client so that he or she can accomplish his or her goals.

13.0 CORRECTIVE ACTION AND COMPLAINT RESOLUTION

A Quality Control Program must have a corrective action implemented into every standard operating procedure. If the level of acceptance set by the methodology is not met, corrective action must be taken immediately. In accordance with EPA SW-846 Chapter 1, Revision 1, December 1992, the following steps are taken to maintain the integrity of the final data package:

1. Identification and definition of the problem;
2. Assignment of responsibility for investigating the problem;
3. Investigation and determination of the cause of the problem;
4. Determination of a corrective action to eliminate the problem;
5. Assigning and accepting responsibility for taking corrective action;
6. Implementing the corrective action and evaluating its effectiveness; and
7. Verifying that the corrective action has eliminated the problem.

These steps apply to any and all standard operating procedures at Del Mar Analytical. Notification of Corrective Action forms, like the one in Figure 13-1, are completed by the Analysts or Project Managers and copies are given to the Quality Assurance Officer for review and filing.

The process for complaint resolution follows the same steps taken with corrective action. If a client has a complaint, the Project Manager has the responsibility to resolve the problem. After a thorough investigation and discussions with the Analyst, Quality Assurance Officer, Laboratory Manager, Technical Manager and/or Laboratory Director, a solution or explanation is derived and recorded in a Corrective Action Report. An example of a Corrective Action Report is presented in Figure 13-2. Every attempt is made to resolve the complaint to the full satisfaction of the client.

Client: _____ Report/Sample #: _____
P/M: _____ Date: _____

<input type="checkbox"/>	Pick-up / delivery missed	<input type="checkbox"/>	Incorrect field sampling procedure
<input type="checkbox"/>	Incorrect containers sent to client	<input type="checkbox"/>	Containers / supplies not delivered
<input type="checkbox"/>	Complaint made by client	<input type="checkbox"/>	Other : _____

<input type="checkbox"/>	Lost samples	<input type="checkbox"/>	Special remarks left out on Analysis Log Sheet
<input type="checkbox"/>	Samples not logged in properly	<input type="checkbox"/>	Samples labeled incorrectly
<input type="checkbox"/>	Improper interpretation of C.O.C	<input type="checkbox"/>	Other: _____
<input type="checkbox"/>	Samples delayed in login	TAT _____	Date Rec'd _____ Date logged in _____

- | | | | |
|--------------------------|--|--------------------------|--|
| <input type="checkbox"/> | L.U.F.T | <input type="checkbox"/> | METALS |
| <input type="checkbox"/> | GC/MS | <input type="checkbox"/> | PESTICIDES |
| <input type="checkbox"/> | PURGEABLES | <input type="checkbox"/> | INORGANIC |
| <input type="checkbox"/> | METALS DIGESTION | <input type="checkbox"/> | ORGANIC EXTRACTION |
| <input type="checkbox"/> | Hold time failure | <input type="checkbox"/> | Incorrect units were used |
| <input type="checkbox"/> | Missed analyses | <input type="checkbox"/> | Analytical interpretation error |
| <input type="checkbox"/> | Calculation errors | <input type="checkbox"/> | Fall to properly interpret C.O.C instructions / wordlist |
| <input type="checkbox"/> | Data turned in without QC | <input type="checkbox"/> | Incorrect use of, or failure to use dilution factors |
| <input type="checkbox"/> | Failure to conform to methodology | <input type="checkbox"/> | Failure to report method used or detection limits |
| <input type="checkbox"/> | Transcription error | <input type="checkbox"/> | Other : _____ |
| <input type="checkbox"/> | Sample number not checked against sample label | | |
| <input type="checkbox"/> | Data turned in late despite analytical results generated on time | | |
| <input type="checkbox"/> | Failure to alert PM with problems which delay reporting of results | | |
| <input type="checkbox"/> | Data is not consistent : | | |
| | Results changed after review | | Results are not consistent within the report |

- | | | | |
|--------------------------|---|--------------------------|---------------------------|
| <input type="checkbox"/> | MARKETING | <input type="checkbox"/> | PROJECT MANAGEMENT |
| <input type="checkbox"/> | Incorrect pricing | <input type="checkbox"/> | Dissatisfied client |
| <input type="checkbox"/> | Errors in Quotation | <input type="checkbox"/> | Other : _____ |
| <input type="checkbox"/> | Analytical capability promised that could not be delivered | | |
| <input type="checkbox"/> | Follow up / status report not delivered to client as promised | | |

[illegible]

Figure 13-2
Corrective Action Report

CORRECTIVE ACTION REPORT

Department: LUFT
Method: EPA mod. 8015
Date: 3-17-94

Client: XXX
Project: XXX
Matrix: Soil

Identification and Definition of Problem:

The a,a,a-trifluorotoluene surrogate used for the EPA mod. 8015 volatile analysis was outside of acceptance limits for samples ABC and XYZ.

Determination of the Cause of the Problem:

Although the sample results were less than 1000 ug/Kg, both samples contained hydrocarbons which coeluted with the surrogate. This coelution resulted in a larger area count for the surrogate peak and therefore, a higher recovery of the surrogate.

Corrective Action:

Since the gas chromatograph is not capable of separating the interfering hydrocarbons from the surrogate, no actions were taken. The surrogates and QA/QC for the other samples were within acceptance limits.

QA/QC Officer Signature:

Debrai Rane

Date:

6-24-94

14.0 PERFORMANCE AUDITS

Del Mar Analytical participates in the following proficiency programs:

1. The EPA Water Pollution Study Audit Program
2. The EPA Water Supply
3. State of Arizona Department of Health Services
4. State of California Department of Health Services

The following licenses, accreditations and certifications are held by the Del Mar Analytical network:

1. A₂LA accreditation
2. State of Arizona DHS for hazardous waste testing and drinking water analyses
3. State of California DHS for hazardous waste testing and drinking water analyses

Each spring and fall quarter, Del Mar Analytical receives ampules from the EPA Performance Evaluation Program for the Water Supply and Water Pollution Studies. In addition, Del Mar Analytical analyzes samples annually for the Daily Monitoring Requirement Quality Assurance (DMR QA) program. These evaluations contain a variety of organic and inorganic analytes whose values are unknown to the laboratory. The analytes must be correctly identified and accurately quantitated. The results of these analyses are kept on file with the Quality Assurance Officer and are available upon request.

Clients are encouraged to submit quality control samples to Del Mar Analytical and on request, arrangements may be made to split samples and subcontract to another laboratory as a confirmatory check.

In addition, performance evaluation samples are administered to Analysts at random intervals. In order to assure that their performance is acceptable, new Analysts are administered check samples immediately after the training program.

15.0 INTERNAL AUDITS

An audit of the laboratory's quality system is conducted by the Internal Quality Assurance Auditor on a yearly basis. All areas of the laboratory are audited to ensure that all policies and procedures outlined in the quality manual are being implemented. Areas of the laboratory that are audited include, but are not limited to, purchasing, data processing/handling, project management, complaint resolution, and sample control. In addition, performance audits are done at random for every Analyst on a yearly basis. The Internal Quality Assurance Auditor reviews the Analyst's files, notebooks and raw data for documentation of all quality control measurements. Each Analyst maintains a series of quality control notebooks which contain sample results, calculations, calibration data, QA/QC recoveries and control charts, copies of corrective action reports, methodology, reagent preparation information, SOPs and method exceptions. Analysts must also have maintenance logs, adequate tools and supplies to keep instruments operational. The Analyst's data reporting procedures are reviewed to ensure that results are easily traceable. The quality system audits and performance audits are documented using checklists based on the most recent Standard Operating Procedure for each area of the laboratory. See Figure 15-1 for an example. During the audit, any problems and/or policy violations are documented by the Internal Quality Assurance Auditor in writing. It is the ultimate responsibility of the Quality Assurance Officer to ensure that corrective actions have been implemented to correct any problems found during an audit. If any audit findings cast doubt on the correctness or validity of test results or calibration, the client whose work may have been affected will be notified in writing immediately. Once corrective action is implemented, a follow-up is scheduled to ensure that the problem has been corrected. See Figure 15-2 for an example of the corrective action and follow-up report that is used for documentation.

Figure 15-1
Internal Quality Assurance Audit Checklist

INTERNAL QUALITY ASSURANCE AUDIT

DEPARTMENT: METALS

ANALYST: _____

DATE: _____

ITEM	ACCEPT.	COMMENTS
Housekeeping is adequate: area is kept clean and free of clutter.		
Instrument maintenance log is current.		
Current methods binder, including clarifications, exceptions and SOP is organized and readily accessible in the lab. Analyst knows location of and has read her or his methods.		
Analyst knows the location of current QA manual.		
Containers have appropriate labels, including reagent bottles and waste containers.		
Date of receipt and of opening is written on the reagent and standard bottles.		
Date of expiration is written on the reagent and standard bottles.		
Chemicals are stored according to compatibility: acids, bases, solvents, solids and standards, etc. stored separately.		
Reagent log is properly filled out with the appropriate information.		
Instrument operating conditions are documented, i.e. argon flow rate(s), calculations and formulas, primary and secondary wavelengths, units etc.		
Detection limits and dates established are documented.		
ICP instrument run logs are current and complete, including analyst's signature, client name, date, dilution/multiplication factor ID, instrument, labwork number and title on the cover.		
All entries are in ink and correction fluid is not used.		
Errors are corrected by lining out with a single line, initialing, and writing the full date.		
Blank pages are marked out with a "Z" and with analyst's signature.		
Corrective action forms are prepared when necessary.		
Personal protective equipment is used properly i.e. labcoats and gloves are always worn, and goggles are always worn when working under the hood or handling acids.		
Calibration is done daily (midpoint), upon method change, or when control limits of 85 - 115 % for Initial Check Standards or Subsequent Check Standards are not met.		

Figure 15-1 (continued)

INTERNAL QUALITY ASSURANCE AUDIT

DEPARTMENT: METALS
(CONTINUED)

ITEM	ACCEPT.	COMMENTS
Complete calibration is done monthly at a minimum of 3 levels plus a blank.		
Coefficient of correlation is 0.995 or greater.		
Initial Check Standard, from a dissimilar source, is run immediately following daily instrument calibration. The recovery must be between 85 - 115 %.		
A Subsequent Check Standard is run after every 10 samples and at the end of a run. The recovery must be between 85 - 115 % for soils, TCLPs, STLCs, hazardous samples and all waters.		
A Blank is run immediately after each Subsequent Check Standard. The Blank must be less than the detection limit.		
The corresponding Method Blank, Method Blank Spike and Method Blank Spike Duplicate are run once during a run in which their associated samples are analyzed.		
The Method Blank must be less than the detection limit.		
The recovery for the Method Blank Spike must be between 80 - 120 %.		
The Matrix Spike (MS) and Matrix Spike Duplicate (MSD) shall be run every 20 samples. The recoveries must be between 80 - 120 % and the relative percent difference (RPD) is < 20%.		
Matrix Spike & Matrix Spike Duplicate sheets (QC Data Report and Control Chart) are filled out and current.		
The Interference Check Solution is run at the beginning of an analytical run and once every week. The recovery must be within 20 % of the true value.		
The Internal Standard of Yttrium is included in every sample except when testing for elements with wavelengths much greater than that of Yttrium, such as Potassium and Sodium.		

QA AUDITOR: _____ ANALYST: _____
(SIGNATURE) (SIGNATURE)

QA OFFICER: _____
(SIGNATURE)

AUDICP

16.0 DATA REDUCTION, REPORTING, REVIEW AND VALIDATION

The data review process at Del Mar Analytical starts at the Sample Control level. Sample Control personnel review chain-of-custody forms and input the sample information and required analyses into a computer database. The transaction of the chain-of-custody forms and the computer data is reviewed by the Sample Control Group Leader. Final review of the chain-of-custody forms and computer data is performed by the Project Managers.

The next level of data review occurs with the Analysts. As results are generated, analysts review their work to ensure that the results generated meet QC requirements and relevant EPA and other Methodologies. Moreover, a second level of review is performed by a second analyst to ensure data compliance. Second level peer review is accomplished by checking analytical results against raw data and evaluating results for accuracy. At this time, blank runs, QA/QC check results, continuing calibration results, laboratory control samples, sample data, and spike information are evaluated. Issues that deem further review include the following:

- The calibration check standard or LCS is out of the specified limits.
- QC spikes and/or duplicate sample data are outside the specified control limits for accuracy and precision.
- Unusual detection limit changes are observed.
- A trend indicating that the QC samples are approaching control limits is observed on control charts.
- Samples having unusually high results.
- Samples exceeding a regulatory limit.
- Raw data indicating some type of contamination or poor technique.

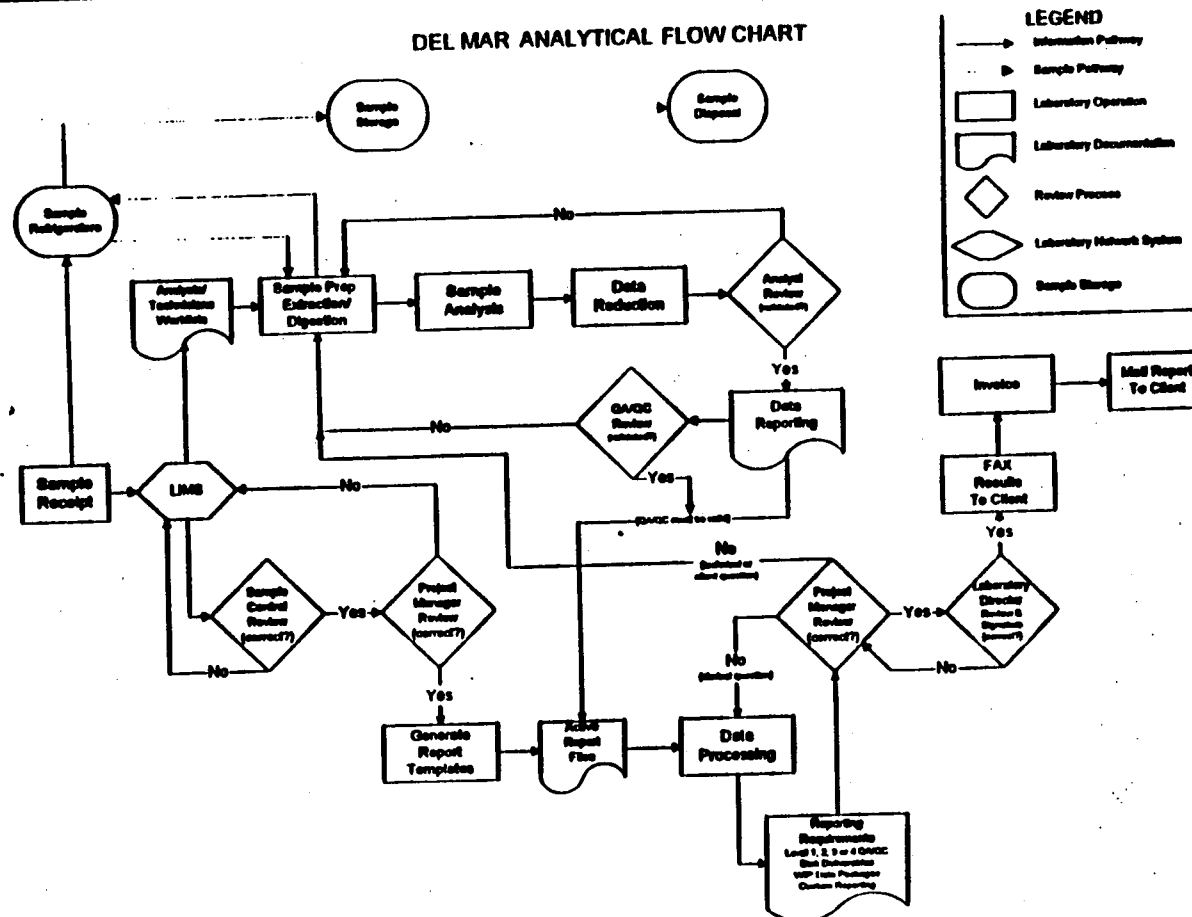
Data which is validated as acceptable by the analysts is transferred onto worksheets. Unacceptable analytical results are brought to the attention of the Laboratory Manager, Project Manager, the Quality Assurance Officer or Technical Manager for further investigation. Corrective action is initiated whenever necessary.

After analysis, the Analyst transcribes the results onto laboratory report worksheets. A random 15% of reports are checked by the Laboratory Manager, Quality Assurance Officer, and/or Technical Manager for transcription errors and acceptable quality control requirements. The results are then entered into the computer database and a hardcopy is printed for the client. The Project Manager reviews the results for appropriateness and completeness. The Project Manager will review the report against most of the same criteria as the Analyst. The primary focus of data review at this level is against previous trends in a project and against information generated by other analyses.

The entire set of worksheets is checked against the chain-of-custody form a second time to assure that all analyses requested have been performed. Quality control results are checked to assure that calculations are correct. Analytical problems identified are brought to both the attention of the Laboratory Manager and the Quality Assurance Officer for corrective action. The final, typed report is then reviewed and signed by the Laboratory Director. The accounting personnel also check the report for any clerical or billing errors. When complete, the report is sent out to the client.

Copies of final reports including the original chain-of-custody form and the laboratory worksheets are kept in a secure filing area for a minimum of ten years. A visual summary of the flow of samples and information through the laboratory, as well as data review and validation, is presented in Figure 16-1.

Figure 16-1
Del Mar Analytical Flow Chart



17.0 TRAINING

At the start of their employment at Del Mar Analytical, all new employees receive a copy of the Employee Handbook, the Chemical Hygiene Plan and a copy of the Quality Assurance Manual. These are his or hers to keep as reference materials. It is the responsibility of the new employee to read, understand and acknowledge the contents of these manuals. Once the new employee has read and understood the contents of the manual, he or she must sign a document that states that he or she agrees to adhere to the requirements prescribed therein. These records are kept on file with the Laboratory Director.

The Employee Handbook contains information about the company's history and objectives, administrative scheduling, benefits, and general administrative policies. The Chemical Hygiene Plan contains pertinent information about the possible hazards of chemicals to which employees may be exposed and how to properly interact with those chemicals. The Quality Assurance Manual contains information about the goals of the Quality Assurance Program and its implementation.

To aid in the training of a new Analyst, each department has a reference binder which includes copies of the methods, all related extraction, cleanup, dilution methods, analytical Standard Operating Procedures, all relevant quality control documentation forms and corrective action reports. The Analyst must read and understand the contents of the binder and be able to answer questions to demonstrate his/her understanding. Additional verbal instruction from an experienced Analyst, the group leader, Technical Manager and the Quality Assurance Officer is provided to ensure a working understanding of the requirements set out by the analytical methods, Quality Assurance Program Manual, Employee Handbook and Chemical Hygiene Plan.

An experienced Analyst introduces the new Analyst to all the instrumentation involved in his or her analyses. Standard Operating Procedures, preventative maintenance, and troubleshooting for the instrument are reviewed by both the experienced and new Analyst. A maintenance logbook explaining any previous history specific to each instrument is reviewed by both the experienced and the new Analyst.

Once the new Analyst feels comfortable with all the analytical and documentation requirements and demonstrates the ability to operate the instrumentation satisfactorily, he or she will spend time observing the actual performance of the analysis by the experienced Analyst. Gradually, the new Analyst will help at various steps in the process in the presence of the experienced Analyst. Eventually, the new Analyst will perform the entire analysis in the presence of the experienced Analyst to ensure adequate proficiency. Once the new Analyst has

demonstrated proficiency in the analytical procedures and has demonstrated the ability to maintain quality assurance documentation. he or she will begin to analyze samples on his or her own.

Once the new Analyst has assumed responsibility for the analysis, routine review of data by the new Analyst's Supervisor continues as part of regular data review processes. Regular auditing by the Internal Quality Assurance Auditor ensures continued compliance with Quality Assurance requirements.

Please see Figure 17-1 as an example of training guidelines for 8240 analyses.

Figure 17-1
Training Guidelines for 8240 Analyses

TRAINING SUMMARY

The following training summary is provided as a guideline for training individuals in Volatile Organic Analysis, specifically EPA methods 624 and 8240.

- I. Introduction
 - A. Equipment
 - 1. Purge and Trap
 - 2. GC
 - 3. MS
 - 4. Data System
 - B. Data System
 - 1. MSDS
 - 2. IDOS
 - C. Method
 - 1. Overview of volatile analysis
 - 2. Method exceptions
 - II. Documentation
 - A. Instrument analysis logbook
 - B. Instrument maintenance logbook
 - C. Standard preparation logbook
 - III. Start-up Procedure
 - A. Bootstrapping
 - IV. Mass Assignment Calibration
 - A. FC-43
 - B. Scan parameters
 - 1. Mass range FC-43,35-525
 - V. Manual Tune
 - A. Parameters
 - 1. Defined
 - 2. Adjustments
 - B. "Ideal" Tune
 - 1. Ratios of masses 69:131:219
 - 2. Resolution
 - C. Documentation
 - 1. Hardcopy of manual time
 - 2. File
-

Figure 17-1 (continued)

TRAINING SUMMARY (Continued)

VI. Creating FC-43 Calibration Table

- A. Acquisition
- B. Check Fit
- C. Documentation
 - 1. Hardcopy fit
 - 2. File

VII. Gas Chromatograph Parameters

- A. Temperature programs
 - 1. BFB
 - a. Isothermal run (170)
 - 2. Standards, blanks, and samples
 - a. Temperature ramp

VIII. Bromofluorobenzene (BFB) Tune

- A. Scan parameters
 - 1. Mass range BFB.35-260
- B. Acquire BFB
- C. Check for pass or fail
 - 1. View chromatogram (CHRO)
 - 2. Select scan (S)
 - a. Identify and explain mass relationship of 50:95:174:177
 - 3. List mass (L)
 - 4. Get report (B)
- D. If BFB fails to meet criteria
 - 1. Document why in logbook
 - 2. Reshoot
 - 3. After 3-4 attempts, manual tune again
- E. If BFB meets criteria
 - 1. Run on a 12 hour curve
 - 2. After 12 hours, re-run BFB

IX. Preparation for analysis

- A. Explain sample lists
 - 1. Sample numbers
 - 2. Sample due dates
 - 3. Sample holding times
 - 4. Special notes
-

Figure 17-1 (continued)

TRAINING SUMMARY (Continued)

- B. Explain matrix
 - 1. Water, drinking water
 - 2. Soil, medium soil
 - 3. Sludge
 - 4. Air
 - C. Finding samples in refrigerator
 - 1. Volatile room
 - 2. Main hall
 - X. Acquisition of standard
 - A. Glassware
 - B. Standards
 - 1. Internal standard and surrogate
 - 2. Volatile standard
 - 3. Miscellaneous standards
 - C. Analysis of standard
 - 1. Water
 - 2. Low soil
 - 3. Medium soil
 - D. Quantitation of standard
 - 1. TCA (DOVO)
 - 2. Mapping in missed compounds
 - 3. Editing quantitation list
 - 4. Updating standard (R:T;S)
 - F. Check standard for compliance
 - 1. 5-Point calibration
 - 2. Daily calibration
 - XI. Acquisition of VOA blank
 - A. Glassware
 - B. Standards
 - 1. Internal standard and surrogate
 - C. Analysis
 - 1. Same conditions as standard
 - D. Quantitation of blank
 - 1. Check IS area
 - 2. Check surrogate recovery
 - 3. Check for compliance (<D.L.)
 - 4. Check for quantitation against correct standard
-

Figure 17-1 (continued)

TRAINING SUMMARY (Continued)

- E. Write up of blank
 - 1. Quantitation list
 - 2. Chromatograms
 - 3. CSPECs
 - a. Spectral matches
 - b. Nonspectral matches
 - 4. Library searches

XII. Analysis of samples

- A. Soils
 - 1. Identify if sample requires dilution
 - a. Observe physical characteristics
 - i. Color
 - ii. Matrix
 - iii. Odor (DO NOT smell directly)
 - b. Client history
 - 2. Sample weights
 - 3. Dilution factors
 - 4. Extractions
- B. Waters
 - 1. Refer to XII A-1
 - 2. Dilution factors
- C. Analysis of samples
- D. Quantitation of samples
- E. Check for compliance
 - 1. Internal standards
 - 2. Surrogates
 - 3. Acceptable limits for amounts
 - a. Calibration curve
 - b. Dilutions
- F. Write up of samples
 - 1. Refer to XI E

XIII. Review final data package

- A. BFB
 - B. DCAL
 - C. Blank
 - D. Samples
-

Figure 17-1 (continued)

TRAINING SUMMARY (Continued)

XIV. Shutdown procedure

XV. QA/QC

- A. Forms to turn in
- B. Nonconformance

XVI. Reporting data

XVII. Miscellaneous section

- A. Stop acquisition
- B. ACQU/O
- C. SAMPLR
- D. Changing number of scans while acquiring
- E. Taping data
- F. Standard preparation
- G. 5-Point calibration
- H. Instrument maintenance
- I. Troubleshooting

_____ has been successfully trained in the above procedures and has demonstrated the ability to perform the analysis, maintain all QA/QC requirements, and report results on his or her own.

Supervisory Signature: _____

Date: _____

QA/QC Officer Signature: _____

Date: _____

18.0 GLOSSARY OF TERMS

ACCREDITATION: Accreditation is awarded to a laboratory which meets the prescribed standards of a recognized accreditation organization. Environmental laboratory accreditation is available from the American Association for Laboratory Accreditation (A₂LA) and the California Department of Health Services Environmental Laboratory Accreditation Program.

ACCURACY: The measure of how close a result is to the true value. It is usually expressed as the percent difference between the true value and the value obtained by an analytical determination. (See Matrix Spike/Matrix Spike Duplicate)

AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION (A₂LA): The American Association for Laboratory Accreditation is an organization which accredits laboratories based upon internationally accepted criteria for competence described in the ISO/IEC Guide 25-1990, "General Requirements for the Competence of Calibration and Testing Laboratories".

ANALYTICAL BATCH: A group of no more than 20 samples of similar matrix which is extracted and/or analyzed together. The chemical reagents and the analytical process is kept constant for each analytical batch. A specific set of quality control samples are analyzed with each analytical batch and are used to estimate the quality of the results of the entire batch.

ATOMIC ABSORPTION SPECTROPHOTOMETER (AA): An instrument which is used to detect and quantify metals. Typically this instrument can analyze only one metal per analysis.

BLANK: A blank is a quality control sample designed to monitor the introduction of contamination into the sampling and analytical process. There are several types of blanks:

Calibration Blank: An organic or aqueous solution that is as free of analytes as possible and prepared with the same volume of reagents used in the preparation of calibration standards. The calibration blank is used to give the "0" reading for the calibration of the instrument.

Equipment Blank: Reagent Grade Water which is opened in the field, poured over and through the sample collection device, and returned to the lab as a sample. Equipment blanks are a check of the cleanliness of the sampling device.

Field Blank: An organic-free aqueous solution that is transferred from one preserved vessel to another at the sampling site. This serves as a check on reagent and environmental contamination.

Method Blank: An organic or aqueous solution that is as free of analyte as possible and is processed in the same manner as an environmental sample. The method blank is used to assess contamination originating from preparation and analytical procedures.

Trip Blank: Reagent Grade Water which is transported to the sampling site in an appropriate sample container and returned to the laboratory without being opened. The trip blank is analyzed to assess contamination originating from sample transport, shipping and site conditions.

Travel Blank: See TRIP BLANK

CERTIFICATION: A state issued document certifying that a laboratory may officially perform environmental analyses for the purpose of determining compliance with environmental regulations. California certification is divided into categories of Drinking Water, Hazardous Waste, Wastewater, Bulk Asbestos Testing, Proposition 65 Analyses, Shellfish Sanitation, Radiochemistry and Pesticide Residues in Food. Each category is further subdivided into "Fields of Testing" which include specific methods. California laboratories are certified for individual fields of testing only after applying for certification and passing an audit.

CHAIN-OF-CUSTODY FORM: The document which includes the signatures of each person who has had custody of the environmental samples from the source to the laboratory. The chain-of-custody form is critical evidence of sample integrity if the laboratory data must be defended in court.

CONTRACT LABORATORY PROGRAM (CLP): A program administered by the EPA which defines the Data Quality Objectives for commercial laboratories hired by the EPA. Acceptance as a CLP laboratory is an EPA vendor approval.

DATA QUALITY: The ability of a specific set of data to satisfy a given purpose. Data quality is affected by sample collection procedures, sample transportation, sample storage integrity, quality control of sample analysis and data reporting.

DATA QUALITY OBJECTIVES (DOO): A description of the factors which define the acceptability of data for a specific project or assessment program.

DATA VALIDATION: A systematic process to review data and to identify outliers, omissions or suspect values in order to assure the validity of the data.

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM (ELAP): The program administered by the California State Department of Health Services which audits and certifies environmental laboratories.

ENVIRONMENTAL SAMPLE: A sample originating from the project site which is analyzed for the purpose of site or process assessment.

GAS CHROMATOGRAPH (GC): An instrument which uses separation technology to detect and quantify organic components of a sample.

GAS CHROMATOGRAPH/MASS SPECTROMETER (GC/MS): A gas chromatograph linked to a mass spectrometer which is capable of identifying chemical compounds based upon their unique ion fragmentation pattern.

HIGH PERFORMANCE LIQUID CHROMATOGRAPH (HPLC): An instrument which uses separation technology to detect and analyze organic compounds. This instrument is typically used to detect and quantify the presence of high molecular weight compounds (semi-volatile) and polar compounds.

ION CHROMATOGRAPH (IC): An instrument which uses separation technology to detect and quantify anions.

INDUCTIVELY COUPLED ARGON PLASMA SPECTROPHOTOMETER (ICP): An instrument used to measure metals. Typically this instrument is used to detect and quantify multiple metals in each analysis.

MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD): A quality control technique used to measure the accuracy and precision of an analytical batch (an analytical batch includes samples of the same matrix). One sample is chosen as a representative of the matrix and is divided into two portions. Each portion of the sample is spiked (fortified) with a known concentration of analyte. One of the spiked portions is the matrix spike (MS), the other portion is the matrix spike duplicate (MSD). The MS and MSD samples are then analyzed in the same manner as the environmental samples in the analytical batch. Accuracy is estimated by subtracting the original, non-spiked sample result from the spiked sample result, and comparing that number to the concentration of spike added. Precision is estimated by comparing the percent of spike recovery of the matrix spike to the matrix spike duplicate.

METHOD DETECTION LIMIT (MDL): The Method Detection Limit is the minimum concentration of an analyte which can be measured and reported with 99% confidence that the value is greater than zero, as performed under ideal operating conditions on a sample with a clean matrix.

MIDPOINT STANDARD: A standard which is analyzed to determine the validity of the multi-point calibration of an instrument. The calibration check standard evaluates the instrument calibration prior to sample analysis. The midpoint standard is also referred to as the "calibration check standard".

PRACTICAL QUANTITATION LIMIT (POL): The Practical Quantitation Limit is the lowest level to be reliably detected within specified limits of precision and accuracy during routine laboratory operating conditions on environmental samples.

PERFORMANCE AUDIT: The planned independent check of the operation of a measurement system to obtain a quantitative measure of the quality of the data generated.

PRECISION: The measure of the repeatability of a determination. Precision is frequently expressed as the relative percent difference between duplicate samples analyzed in the same manner. (See Matrix Spike/Matrix Spike Duplicate).

PURGE AND TRAP: A sample preparation device which is used to extract and concentrate volatile components from a sample. The sample is placed in a sealed vessel, then purged with a stream of inert gas. The stream of gas and volatiles from the sample are swept onto a solid adsorbent trap. After purging the sample

for the prescribed time period, the trap is rapidly heated and back flushed into the gas chromatograph for analysis.

QUALITY ASSURANCE: The integrated program for assuring the reliability of laboratory data. Quality Assurance incorporates quality control of the procedures for field sampling, sample handling and storage, analytical processes and document preparation and review.

QUALITY CONTROL: The routine application of procedures for obtaining prescribed standards of performance and rejecting performance which does not meet the prescribed standards.

QUALITY CONTROL SAMPLE: A sample originating in the field or in the laboratory which is analyzed for the purpose of assessing quality control.

REAGENT GRADE: Analytical Reagent (AR) Grade, ACS Reagent Grade and Reagent Grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

SAMPLE: A discreet representative part or a single item from a larger group presented to the laboratory for analysis.

Duplicate Sample: A replicate sample which is intended to be identical to the original sample. A duplicate sample can originate from the project site and be in a separate sample container or may be generated in the laboratory by splitting a sample into two portions.

Laboratory Control Sample (LCS): A blank sample which has been spiked (fortified) with the method analytes and analyzed in the same manner as the environmental samples. The standard mixture used to spike the LCS must be obtained from a source other than the primary calibration standard mixture. The LCS is sometimes referred to as a "blank spike" and is used to determine the overall performance of the instrument, as well as to determine the validity of the calibration standards.

REAGENT WATER: Distilled or de-ionized water which is free of contaminants that may interfere with the analytical test.

SEMI-VOLATILE ANALYTES (EXTRACTABLES): A general term used to describe a group of compounds which are not volatile at ambient temperature. These analytes are extracted from samples using organic solvents.

STANDARD: A solution of known concentration which contains the method analytes. Standards are used to calibrate the instruments and to create quality control samples of known concentration.

Calibration Standard: Dilutions of stock standard solutions prepared at various concentrations which are used to generate a calibration curve for an analysis.

Calibration Check Standard: A standard which is analyzed to determine the validity of the multi-point calibration of an instrument. The calibration check standard evaluates the instrument calibration prior to sample analysis. The calibration check standard is also referred to as the "daily midpoint standard".

STANDARD CURVE: A graph of the calibration standard concentration versus instrument response for an analyte. The standard curve illustrates the quantitation range for an analyte. The concentration of analyte in an environmental sample can then be determined by taking the sample instrument response and calculating the appropriate concentration from the standard curve.

STANDARD METHODS: Standard Methods for the Examination of Water and Wastewater, is a reference book of analytical methods prepared and published jointly by the American Public Health Association, the American Water Works Association and the Water Environment Federation. The methods are very similar to EPA methods and are recognized by most regulatory agencies for drinking water and wastewater. Unlike the EPA methods, each Standard Method begins with a discussion of the method principles and its application to water samples.

STANDARD OPERATING PROCEDURE (SOP): A written procedure for performing an operation, analysis or protocol. An SOP is prepared for each extraction and analysis in the laboratory which consists of the published method to be used and includes any method exceptions.

SURROGATE: Surrogate compounds are similar in chemical composition to the target analytes and are spiked into every sample prior to analysis. The surrogate compounds selected are not found in environmental samples. Surrogates are spiked into both environmental samples and quality control samples prior to analysis. The percent

recoveries of the surrogates are calculated and are the primary data used to assess the recovery of target analytes.

SW-846: The EPA document "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods". This is the source document for hazardous waste analytical methods.

TITLE 22: California Code of Regulations, Title 22. Social Security, Division 4. Environmental Health, is the group of California laws which apply to water quality and hazardous waste management.

VOLATILE ORGANIC ANALYTE (VOA): A general term used to describe a range of organic compounds which are volatile at ambient temperature. These compounds are usually extracted from samples by purging with a stream of inert gas and trapping the volatiles on a solid adsorbent (purge and trap).